AMATEUR WORK

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A STUDENT'S DESK.

JOHN F. ADAMS.

In the design here given for a student's desk, the aim has been to provide ample storage room for writing materials, shelves for books, etc., and yet retain an unobstructed surface for work, which shall receive as much light from all directions as possible. Possessing these requirements, it will undoubtedly interest others than the class for whom it is specially provided.

Oak is the most suitable wood of which to make it, and the finish should be a deep brown or green stain, and dull polish. Black iron or oxidized brass hinges and pulls should be used if obtainable.

The top measures 40 in. long, 24 in. deep and 1 in. thick, and the several pieces should be carefully matched as to grain. At the back is a board 39 in. long, 7 in. wide at the center, 5½ in. wide for a distance of 6 in. at each end and ¾ in. thick. The ends of the wide portion are rounded down to the narrower part as shown in Fig. 2.

The fronts of the two covered pockets are 8 in. long, 2 in. wide; all the pieces in the same are ½ in. thick. The top pieces are 9 in. long and 2 in. wide, the front edges being bevelled square with the slope of the cover. The outer end pieces are 8 in. long, 6 in. wide at the back and 2 in. wide at the front. The joints with the back piece are mitred. The inner end pieces of the pockets are 7½ in. long and 7½ in. wide. A shelf 17 in. long, 3 in. wide and ½ in. thick is placed 3 in. above the top of the desk. It is secured in place by nailing through the inner ends of the pockets and the back.

The under framework requires two pieces 26½ in. long, 8 in. wide and ¾ in. thick; two pieces at the

FIG. 2.

front the same length and thickness and 1½ in. wide. Also, two base pieces, 24 in. long, 3 in. wide and 1½ in. thick, the under edge being cut out as shown in Fig. 3. The cross pieces at the ends are 14 in. long, 7 in. wide and ¾ in. thick. The joints, for all these pieces are mortised and firmly glued when put together.

The front cross piece over the drawers is 37 in. long, 1 in. wide and ¾ in. thick. The piece under the draw-

ers is 2 in. wide at the ends, cut down in a long curve to 1¼ in. wide at the center. The piece dividing the drawers is 5 in. long and 1 in. wide. These dimensions all allow ½ in. at each end for tenons.

The under framework is attached to the top by means of strips fastened to the inner sides of the ends, and by screws through the front piece over the drawers.

The shelf at the bottom is 37 in. long, 19 in. wide and ⅞ in. thick, mortises ½ in. deep being cut in the base pieces for it. At the back is a stop piece 36 in. long and 1 in. wide, nailed on. The other shelf is 36 in. long, if nailed in place, 37 in. long if mortised, which is preferable, and 8 in. wide. It is located 10 in. above the lower shelf.

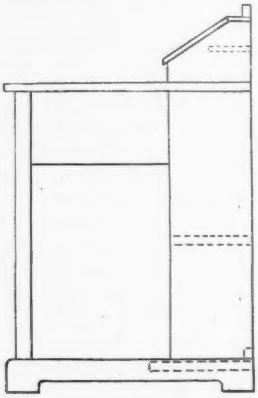


FIG. 3.

The two drawers are 17½ in. long, 22 in. wide and 4 in. deep. A frame work is glued up to form the run, the construction of which can be learned by examining any bureau or similar piece of furniture, as can also the proper way to make the drawers. The principal requisite to get a rigid desk is to have all joints carefully fitted and well secured with glue, adding nails sparingly where it may seem desirable.

PHYSICAL SCIENCE.

The accomplishments of physical science are truly wonderful. While, perhaps, not appealing as strongly to the lay mind as does the work of the engineer, they must nevertheless be counted among the greatest achievements of our civilization. One striking illustration of the marvellous potency of scientific methods is the addition to our knowledge of the nature of things has been gained through the study of radium.

The phenomenon of radioactivity has been known only ten years and was entirely new when discovered. It seemed utterly opposed to our previous conceptions of matter, yet in ten years we have made such progress that we now feel that we know vastly more about the molecule than we had any hopes of learning for a long time before the discovery of radioactivity. And that is not all, for ten years ago we had no basis for believing that an atom could be broken up, while now we seem to know more about the constituent parts of the atom than we previously knew of the atom itself. We have not only shown that an atom can be broken up, but we have shown that, in certain cases, this disintegrating process is exceedingly complex and takes place in successive stages, one following the other.

Uranium, for example, which is supposed to be the parent element of radium, first breaks up, forming uraninm X which then changes to radium. Radium then gives off the so-called emanation, and this, in various ways, goes through six stages, finally reaching the form known as radium F. As yet no further change has been traced, but Prof. Rutherford, who has been particularly instrumental in this remarkable work, thinks that it is probable that finally lead is formed, since this material is always found associated with radium ores in quantities suggesting the inference.

Besides this determination of the stages of decomposition of the radioactive materials, the character of these changes has been determined; in fact, it is from the peculiarities of the latter that the various stages have been recognized. During certain of the changes particles of charged matter—if we may still use this term—are thrown off at terrific velocities, and produce disastrous effects upon any other material which may lie in their way; in fact, these minute projectiles actually shatter to pieces molecules of matter which they encounter.

Naturally, the laws governing the movement of these atomic fragments would be of the greatest interest to science, and it is with the sense of gratification that one learns that recent researches seem to indicate that they are neither more nor less than the laws of motion enunciated by Newton for terrestrial matter, and later extended to the visible universe.

Truly, these developments of physical science are of the greatest importance, and it is worthy of remark that they have been accomplished by the means of simple apparatus, though, of course, constructed in a refined way. With mathematics as his dark lantern, and a simple electrical instrument as a jimmy, the scientific burglar is rapidly depriving Nature of some of her most cherished secrets. Fortunately for the pleasure of the burglar, the further he penetrates into Nature's treasure house, the larger does he find it to be and the richer the treasure.

Deserts occur at all elevations, from depths below sea level to thousands of feet above, and with numerous variations in the surface, from a flat expanse of sand, where the view for days of travel is bounded by a sharp circle as at sea, to rocky mountain slopes rent by rough defiles, bare and chiseled by driving sand.

INDUCTION COIL MAKING FOR AMATEURS.

FRANK W. POWERS.

VII. Experiments with Induction Coils.

The experiments that may be performed with an induction coil are to some extent dependent upon the spark capacity of the coil, but as many attractive and interesting ones require a coil giving only a ½ in. spark, the owners of small coils have no reason to be discouraged because of the lack of a large coil. For X-ray work a 4 in. spark coil is about the smallest with which radiographs of the bones of the hand can be satisfactorily obtained, and a coil of much greater capacity is generally used. A 4-in. induction coil in series with a Tesla coil gives beautiful results, but this branch of coil work must be held for a future series of articles.

The vacuum or "Geissler" tube is at once the most interesting and spectacular accessory of an induction coil, and owing to the great variety of such tubes, can profitably receive considerable attention from the amateur experimenter. These tubes are made of thin glass in a multitude of shapes and sizes, with platinum electrodes sealed into the ends and the enclosed space partially exhausted of air, or the air replaced by certain rarified gases, each one having its own peculiar color of incandesence when excited by the current from a coil. For instance, nitrogen will give a reddish light at the positive end, and violet or light blue a the negative end. With hydrogen the colors are crimson and blue, while carbonic acid gas gives green and lavender blue, but arranged in rings or discs.

Compound tubes are also made, in which the tube having the electrodes is enclosed in another tube, the latter generally straight, and the space between the two tubes is filled with a colored fluorescent solution, which gives a beautiful tint to the light within the inner tube. Another type of tubes has the form of a large bulb, and contains what is seemingly a group of dull clay figures or spray of flowers with leaves, but which assume most beautiful colors when connected to the coil. The latter are quite expensive, however, and are not commonly seen, but are well worth the having by those who can afford them.

The size of tubes varies from the small, single tubes 3 in. long, to the large, compound tubes 15 in. long. The small ones can be made luminous with a coil giving only a ½-in. spark, but a ½-in. spark is necessary to secure full brilliancy. An easy way of estimating the spark requirements is to allow from three to four feet of tube for each inch of spark, much depending on the "fatness" of the spark. The writer has a frame with six 12-in. tubes in series, which are very brilliant with the spark gap on the coil set at 1 inch.

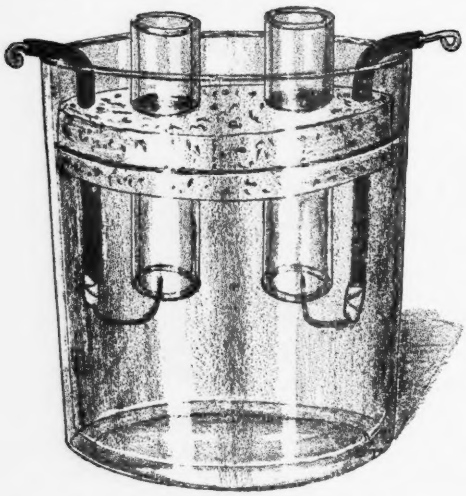
If the electrodes of the tubes become quite hot with continued operation, the spark gap is excessive, or the connection have too much resistance. The connecting terminals of tubes are quite easily broken off, and to avoid such breakage it is advisable to use stranded wire, such as is used for electric drop lights. The strands are easily twisted around the loops of the tubes, and a better connection obtained than with magnet wire. In the event of the terminal of a tube being broken off, it can easily be repaired by placing a small bead of tin foil, softly rolled up, inside the cup shaped terminal, pressing same against the end of the platinum electrode and fastening with sealing wax, shellac or liquid glue applied around the edges.

GASSIOT'S CASCADE.

Still another form of tube is that known as "Gassiot's cascade," the form being shown in the accompanying illustration. It was originally performed with table glasses under a bell glass of an air pump, but the special parts can now be imported made up ready for use. It makes a most striking class-room demonstration if the windows are shaded to darken the room, and would also make a fine window display after sunset. It consists of a large glass bulb enclosing a glass goblet which rests upon projections on the shoulders of the bulb to give a little space between the base of the goblet and the walls of the bulb. The

cover has a neck projecting down nearly to the bottom of the goblet, and a platinum wire electrode fused into the top. In the lower bulb is another electrode, and all is supported by a suitable base. A partial vacuum is obtained with an air pump, and the electrodes connected to the coil, when the light seems to flow in a stream from the upper electrode down through the neck into the goblet, which appears to quickly fill and overflow around the top, down the sides into the lower bulb to the other electrode.

An interesting experiment which impresses those unacquainted with high tension effects, is to take hold of one end of a vacuum tube, place the other end of tube on the positive discharging rods of the coil, pointing with the other hand to the negative discharger, the discharge gap being about ½ in. As the moving finger draws near to the discharger, a slight shock will be felt in the arms and the tube will begin to glow, the brightness increasing the nearer the finger is brought to the negative discharger, and fainter as the hand is drawn back. The end of the free finger should not be brought into actual contact with the discharger, as a smart shock will be given should this occur.



DECOMPOSITION OF WATER.

An incandescent lamp will also glow under the same conditions, whether it has a filiament or not, by touching one terminal of the lamp to the positive discharge. With a large coil it is not even necessary to have actual contact; placing the lamp between the dischargers will cause it to glow.

If the coil be fitted with dischargers having sharpened points, paper, cardboard, glass and other substances may be perforated. Place the piece of cardboard between the points and start the coil; sparks will pass through, forming round, slightly charred holes. The gap between the points should be about one-half that of the coil capacity. To pierce glass it is necessary to support it so that it remains fixed and the spark continuously applied to the same point. If the spark plays around the surface of the glass, make two deep rings of sealing wax and affix to either side of the glass. Place the points of the discharges within the wax rings and start the coil. The rings will hold the spark to one spot and a hole will soon be perforated.

A miniature arc light can be made from a lead pencil having a large, soft lead. Cut the point into two pieces, remove the wood from each end, wind several turns of No. 20 magnet wire around one end of each piece and connect to the dischargers. Place the pieces of pencil on two tumblers and bring the free ends nearly together; start the coil and then adjust the gap until the arc is formed, when a brilliant white light will be given off.

Using the pointed dischargers, twist around the ends pieces of fine iron wire, bring the free ends of the wire together till sparks pass freely, and until one wire becomes white hot, when it will burn brightly, emitting sparks of burning metal. Substitute copper wire for the iron wire and note the change in the color of the light.

Prepare metal filings with a clean, coarse file, sprinkle a layer of fine filings upon a sheet of ebonite, start the coil and bring the discharger points to opposite edges of the filings. Part of the filings will be fired and the spark will have a zigzag shape with color varying with the metal. Copper, nickel and silver coins can be used to furnish filings of these metals. Strips of metal foil of the various kinds used for signs will be consumed in a brilliant flash, the color varying with the metal.

Take a discarded photographic plate and upon it attach with shellac a piece of tin foil cut to the shape of of a star or diamond. When the shellac is dry cut lines through the foil with a knife. Place the plate so that the discharger points are near opposite points of the foil figure and start the coil, when sparks will appear at the knife marks. With large coils, large foil signs can be illuminated with striking effect, a flaming discharge being the most effective.

The superior conductivity of heated air is shown by bringing the flame of a lighted candle near the discharger points. Blow out the candle and hold the wick between the points when the candle will be relighted, provided the wick still has a red glow.

The decomposition of water is an old but interesting experiment, and the materials necessary are easily obtained. Two pieces of platinum wire about 1 in. long are soldered to two pieces of No. 18, waterproof insulated wire, the joint being wrapped with electricians' tape and then thickly shellacked, so that only the platinum wire is exposed. Bend the platinums' ends backward to form hooks, and twist the outer ends of the insulated wire into spirals, so that when placed over the opposite sides of a glass tumbler the hooks will be a short distance above the bottom of the glass.

Fill the tumbler nearly full of water, strongly acidulated with sulphuric acid or vinegar. Obtain a disk of cork large enough to fill the top of the tumbler, bore two holes with centers about 1 in. apart to receive two 3 in. pieces of glass tubing ¼ or ⅜ in. diameter. Place the cork and tubes in the tumbler and arrange the hooks so the points will be inside the lower ends of the tubes. Connect the free ends of the copper wires to the coil dischargers and start the coil. Bubbles will rise in the tubes, oxygen gas rising at the positive and hydrogen gas at the negative wire; the quantity of hydrogen gas will be about double that of the oxygen gas.

As frequent mention has been made of positive and negative discharger, it will be desirable to have a convenient way of determining which these are. Obtain some white photographic blotting paper, as this kind is free from intertering chemicals, and soak in thin, hot washing starch. After the starch is dry, dip in a solution of iodide of potassium, one ounce, and water one pint, and dry. To use, dip in water, place upon a sheet of clear glass and place between the dischargers. Start the coil and the paper around the positive pole will turn to a purple or brown shade.

HAULING OUT BOATS FOR THE WINTER.

CARL H. CLARK.

The beginning of the present month will, with the large majority of boat and launch sailors, mark the close of the season, and the next thoughts will be in regard to hauling out and storing the boats for the winter.

All cabin fittings and furnishings should be removed and taken ashore, and all loose dunnage and odds and ends cleaned out and removed. There is certain to be a large collection of loose stuff after a season's use, the larger part of which may best be thrown away.

The sails should be unbent and, together with the cushions and other fittings, should be thoroughly dried out in the sun. When completely dry and warm the sails should be tightly rolled up and packed away, preferably in canvas bags. If the cushions are expensive ones they may be done up in cotton cloth, otherwise they may simply be tied together in neat bundles. These furnishings and the sails should be stored in a dry place, such as a loft, as any moisture is sure to cause mildew and spoil the appearance of the sails. They should also, if possible, be protected from rats and mice.

Spars should be stored under cover, and in such position that there will be no tendency to bend out of shape. It is always advisable to unstep the mast and protect it from the weather, as it not only prevents it from rotting but makes it easier to scrape and varnish in the spring. When spars are left standing they should be either wrapped with strips of cloth, or covered with a preparation of tallow or similar substance to protect the wood from the weather and prevent its becoming permanently stained.

All inside ballast should be taken out, not only to make the hauling easier, but to relieve the boat of the unusual strain which would come from the weight during the winter. The boat should then be thoroughly washed inside and all rust and dirt cleaned out so as to have the bilge clean and sweet. It is far easier to get rid of the dirt in this manner, as chips and light matter will float and may be picked out, and then dirt will settle in the bottom and may be scraped up while it is soft. In this way the inside of the boat may be left clean. In the case of a power boat, all the grease should be carefully scraped out from under the engine and the plank and frames washed clean. Strong lye or potash will help in dissolving this grease.

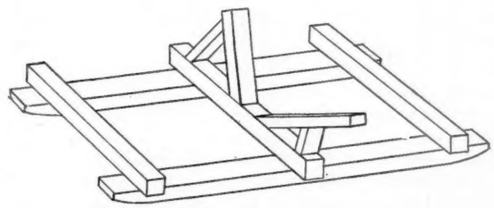


FIG. 1.

For storing the boat a dry spot should be chosen, but if possible it should not be exposed to the direct sun on account of this drying tendency. While the ground on which the boat is hauled should be perfectly dry, it is advisable to take advantage of the shade of some building or trees to shield it as much as possible from the direct sunlight.

For hauling out the boat a cradle of some sort should be used; the simplest and most convenient form, shown in Fig. 1, consists of a pair fore-and-aft timbers slightly shorter than the boat, with two or three cross timbers whose length is about the same as the beam. For small boats the timbers should be about 4 x 4 in. while for larger boats 4 x 6 in., 6 x 6 in., or even 6 x 8 in., are used, according to the size of the boat. The timbers are bolted together with ½ or ⅝ in. bolts, the cross pieces on the top of the fore-and-aft ones. Since rolls will most likely be used under the fore and-aft pieces, the ends of the latter should be bevelled off so as to more easily ride up on to the rollers.

To steady the boat on the cradle a pair of V-shaped chocks or braces are fastened on the middle cross

piece, which fit up under the bilge and maintain the boat upright.

To put the boat upon the cradle, it is brought into shallow water, and in the case of a small boat a cradle may be pushed under her. With a larger boat this should be done at high tide; it may also be necessary to ballast the cradle in order to push it under the boat; when it is in place the ballast is pushed off and both boat and cradle drawn in until the latter grounds, taking care not to change the position of the boat on the cradle. When the tide receeds the work of hauling out may be done. Wood rolls 5 or 6 in. in diameter are used, with a double row of planks under each fore and aft piece. For motive power a winch or several purchases of tackle blocks are used, according to the size of the boat. For small boats, a cradle built according to Fig. 2 is very useful, as with it a boat of small or medium size may be hauled a considerable distance with the aid of a horse. In this manner the boat may be hauled into the owner's yard and be convenient for spring overhauling, repairs or alterations.

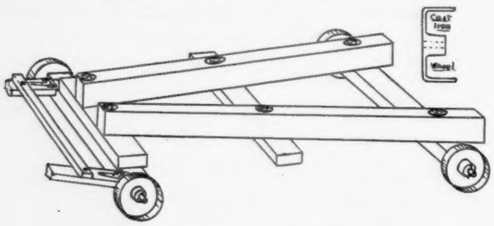


FIG. 2.

When hauled into place the boat should be blocked up level and well shored fore and aft. Shores should be fitted under the ends of the keel, and it should not be allowed to extend unsupported, as this brings an unnecessary strain upon the boat.

The boat should now be left open to the air for a few days in order to thoroughly dry out before being covered over for the winter. It should be arranged when possible so that a current of air will circulate through her at all times, as moist dead air is one of the best promoters of dry rot.

If the boat contains an engine it should now be thoroughly cleaned. Cylinder covers and hand hole plates should be taken off and the oil and deposits entirely removed. All bright parts should be polished and then smeared with thick grease for protection against moisture. Any parts which have shown signs of wear and need of repairs should be removed at this time.

In the case of a small engine it is advisable to remove the entire engine from the boat. It may then be taken to some convenient place and cared for, and any repairs or improvements may be made at leisure during the winter. All of the ports, passages and bearings should be liberally flushed with kerosene oil to remove all of the old oil which would become sticky and hard before the engine is used again. If the varnished work shows signs of wear it should be given a coat of shellac to keep out the weather and preserve it. A coat of tallow and oil is also an excellent preservative and facilitates the scraping in the spring.

A cover, either of boards or canvas, should be built over the boat; if the latter, a framework may be built over which the canvas may be laid. Some access should be allowed for the air, to prevent the interior from becoming stale and musty, with possibilities of rust.

The practice of hauling under a shed, which is becoming quite common in yacht storage yards, is greatly to be recommended, as it not only saves the trouble of covering up, but allows the boat to be well ventilated at all times, and allows of much work being done in the early part of the spring when it would not be possible to work in the open, thus saving much time. This is by far the most desirable method of storage and should be taken advantage of whenever convenient.

The higher the compression in a gas engine the weaker must be the mixture; that is to say, the ratio of air to gas increases with the compression. Broken crank shafts and bad plates, as well as cracked breech ends, are generally due to the lack of strength and stiffness of the engine. A gas engine requires to be built on the lines of a gun, since its action is of similar nature; therefore engines of the vertical type cannot have the stiffness which is present in the horizontal engine. When the running of an engine gives rise to shock or knocking, it is likely that the speed is too great. Current practice for a 500 h. p. engine would be about 135 r. p. m. with a piston speed of 700 ft. per minute; but the engine would do better at 120 r. p. m., with the same piston speed.

Palladium was discovered in 1803 by Wollaston while purifying crude platinum. Palladium occurs native in platinum ores and also alloyed with gold and silver ores from Brazil. It is a ductile, malleable white metal with a specific gravity of 11.8 and possessing the lowest melting point of all the platinum metals. It is used in the manufacture of fine scientific instruments, from its properties of hardness, color and resistance to the action of the atmosphere. Alloyed with silver it is used in dentistry to a small extent as a substitute for gold in the filling of teeth. It is quite rare and were it in more plentiful quantity the metal would be most valuable commercially.

The metre is the unit of length of the metric system of weights and measures and was intended to represent the one ten-millionth of the quadrant of the earth measured on a meridian from either pole to the equator. The gram is the unit of weight, which is the weight of a cubic centimetre of pure water at its greatest density—4.5 ° C., or 40° F. The latitude is a negligible factor.

EARTHED AND UNEARTHED RADIATORS IN WIRELESS TELEGRAPHY.

W. H. ECCLES, D. SC.

Recent commendations of certain new Lodge-Muirhead wireless telegraph stations equipped with insulated oscillators and resonators of the 1897 English patent, make the moment opportune for a brief review of the reasons and facts that have made the use of the earthed radiator almost universal and the use of one unearthed rather exceptional. A plain statement of the present position of the rival cults—the earthed and the unearthed—in the light of widely accepted theory, can be made and is best made without recourse to mathematics.

In the early days of Hertzian space telegraphy, say ten years ago, the solution of the signaling problem was expected in the employment of straight beams of electrical radiation. The electric rays used, produced of course in the Hertzian manner, were to be projected in any desired direction, and were to be capable of penetrating all obstacles between the sender and receiver. Hence it was that radiation of short wave length generated at the focus of a parabolic mirror was the vogue among the "wireless" experimenters of that day. It was probably in an endeavor to get a bigger output of radiation per spark that Marconi in 1895 connected large insulated conductors — storehouses—to one side of his oscillator. Contrary, perhaps, to what he had expected, signals were better when these insulated conductors were lifted to a distance from the earth (and their capacity thus reduced) and better still when the far side of the spark-gap was earthed. In fact, capacity in itself seems of so little account that the large elevated conductor could be removed and the connecting wire left supported alone in the air without greatly diminishing the strength of signals. Thus Marconi followed Popoff without copying him, to the use of the plain earthed air-wire, originally designed, it seems, by Popoff for other purposes than wireless telegraphy.

The scientific basis, as we understand it, of these rapid successes of Marconi have been given numberless times. We see clearly enough now that it supports Marconi's own opinion that his success was largely due to the earthed air-wire. It is necessary here to write down once again the virtues, as oscillator and radiator, of the long vertical earthed air-wire. Put shortly, its merits are: First, its great length inspires slow vibrations, and therefore long waves; second, it sets up the waves so that the electric force in a wave front is, from the very beginning, in a vertical plane; third, what is partly implied in the last, it attaches to the surface of the earth the free ends of the moving lines of force; fourth, it is a good radiator and absorber.

Long waves are advantageous largely for reasons connected with diffraction; the setting vertically of the electric force near the earth avoids losses such as would otherwise occur from the generation of profitless currents in the earth's substance; and the attachment of the waves to the earth's surface prevents them straying wholly into space, and gives them such guidance (similar to that given by a wire to the current it carries) as enables ranges of hills to be surmounted without suggestion of penetration. But the air-wire's power as a good radiator, valuable at a time when the object was to "get there," has become in this era of syntonic ambition, its cheafest fault if it is in itself the whole oscillator; for, as has often been explained, rapid radiation shortens enormously the train of effective waves if, as must be in the case of the simple air wire, the energy stored electrostatically, just before each spark, is small. There is no need to do more here than mention that by using a closed (non-radiating) oscillator of great energy capacity to feed the simple air-wire, sustained trains of waves can be omitted and the earthed air-wire thus retained in its old post of honor.

At a very early stage of this story, Lodge seems to have perceived this inadequacy of the simple air-wire for syntonic working; and at least as early as 1897, was using in preference a symmetrical Hertzian wave-maker. The one at Heysham, for example, consists of two horizontal conducting plane areas about 80 feet square, one vertically above the other, and connected to it by a vertical central wire about 80 feet long. The lower square is about three feet from the ground and, like the upper, is insulated. The vertical wire is interrupted at its middle by a spark gap. This structure is from its geometrical configuration, a slower generator than a simple air-wire, and gathers before each spark a much greater charge.

For both reasons it produces trains or waves more sustained than those of the air-wire. Moreover, it possesses most of the merits of the plain air-wire. It makes very long waves, and it sets them up with their moving lines of force in vertical planes. But it fails in this, that it does not attach the waves to the earth's surface. The waves have to do that for themselves, as they may do when free later on. To compensate for this, however, there stands the complete freedom from earth connection. What this means can only be appreciated by recalling one, let us say, of the difficulties that beset the radiator that is earthed, namely the variability in the goodness of the "earth."

This variation of quality of "earth" did not matter so much in untuned working, but in tuned telegraphy it is more important; and when making comparisons with the Lodge-Muirhead wave-maker, we must look to tuned systems. Suppose then, that in a syntonic transmitter the radiator is tuned to the closed feeding

circuit when there is a good earth, and that by some means the earth goes bad—*i. e.*, acquires an unwonted resistance. Then, inevitably, foreign overtones, of kind and strength depending on the badness of the earth, are introduced into the vibration. These overtones are produced at the expense of the fundamental by reflection at the resistance of the pulses descending the air-wire.

There is, besides, absorption of energy in the resistance; indeed, it has been shown both theoretically and experimentally, that with a certain critical resistance, the absorption of the vibrations in the resistance may be extremely rapid. If this last condition is ever happened upon in practice, it must be of serious import even when forced vibrations of the correct period, namely, that of the distant receiver, can be maintained upon a transmitter air-wire by a heavy feeding system behind it. All these considerations apply with equal or even greater force to the earthed absorbing wire of the receiving system. Hence it will be seen, to be earth free is something worth striving for. Thus the question is, does the attainment of this desideratum by the Lodge-Muirhead wave-maker, compensate fully for the fact that the waves as at first emitted are free, that is, unattached to the earth's surface?

If one traces in imagination the movements of the lines of electric force near the Lodge-Muirhead radiator when in action, he concludes that the lines which detach themselves from the conductor to form waves appear as rings situated in vertical planes passing through the vertical central wire, moving outward horizontally with the speed of light and expanding as they go. They will resemble, in fact, the rings familiar to us in diagrams of the ordinary Hertzian oscillator, but will probably be more distorted than those in the pictures and will include a smaller proportion of the whole number of lines of force initially present in the fully charged oscillator. As each ring moves forward and expands, its lower bend strikes the earth and is reflected or absorbed there. If the earth's surface were of very good conducting material, the lower half of each ring would ultimately be folded up towards coincidence with the upper half.

Now, in this process of reflection, the direction of the horizontal component of electrical force is reversed. Thus, high reflection at the earth's surface would involve considerable strengthening of the waves near the earth—just where the strength is wanted. As a matter of working experience, this strengthening by reflection seems not to be experienced at the earth's surface in any degree so completely as has just been indicated; but it is well admitted that the earth's surface cannot be supposed a perfect conductor. The folding up of the lower half of each looped line of force is probably very incomplete. Allowing for this, it seems possible that perhaps one-half of the whole wave energy—the half carried in the lower portion of each ring of force—may be wasted ohmically in the earth comparatively near the radiator.

On the other hand, the earthed radiator, placed normally over a conducting sheet (the earth to which it is connected) detaches, in the popular theory, half rings, which move outwards in vertical radial planes, with their cut ends sliding perpendicularly over the conducting plane. This arrangement seems ideally perfect. But here again the earth's surface is, in reality, not a good conductor. Therefore, in the very act of electrical vibration — which may be interpreted, as is well known, in terms of positive and negative reflections of electricity at the top and bottom of the earthed air-wire—great wastage may occur before the detachment of the waves.

In both cases lines of force travelling over a bad conductor must acquire a forward slope which will involve the propagation of energy into the earth or, to put it in another way, will involve the creation of currents in the earth's substance with consequent ohmic losses. Taking all this into account, however, as well as may be done by these descriptive methods of examining the question, the advantage, on the whole, seems to lie with the earthed radiator. The conclusions we are driven to amount, in fact, to these: That in the case of the Lodge-Muirhead radiator working over the badly-conducting earth a 50 per cent. ohmic loss of the whole output of radiation is possible; whereas with the earthed radiator there are losses in vibrational energy amounting probably to a smaller figure.

MAKING ROADS IN ALASKA.

A serious detriment to the making of a road in Alaska is the thawing of the ground beneath the moss. It has been the universal experience that whenever the moss is cut into, thawing immediately commences, and the trail which was passable becomes a filthy, slimy mass of mud, roots and broken stones—a difficult route for men on foot, a slow and tiresome road for loaded animals, and an impassable obstacle to any sort of vehicle. In regions further south, under temperate conditions, trails frequently are developed into fair wagon roads by much usage. Such developments can never take place in any part of the Northwest.

A VALUABLE MINERAL SPECIMEN.

One of the most valuable of mineral specimens for the cabinet is the mineral rhodochrosite, or native manganese carbonate. When in fine crystals of rose pink color, a specimen of fair size is as valuable as an equal bulk in silver. A collector to purchase a really fine specimen of rhodochrosite today, would in all probability have to secure the same from some mineral collection, as there is an absolute scarcity of good specimens in the market.

PHOTOGRAPHY.

ART TONES IN P. O. P. DEVELOPMENT.

STANLEY C. JOHNSON, B. A.

What a delightful range of tones may be secured with comparative ease by partial printing and subsequent development of P. O. P! Red chalks and ivory blacks, it is true, are not obtainable, but all sorts of pleasing greens, rich browns, and many useful shades of violet are well within the limits. The process from end to end may be carried out at night-time in an ordinary sitting-room; it might almost be said in an arm-chair. The reader therefore cannot complain of its intricacies.

The working will be familiar to all those who use gaslight paper. Open a fresh packet of P. O. P. and fill the print frames in a shaded corner of the room. Odd sheets taken from an almost finished packet left over from last summer will not do. Keep the supply intended for development quite separate, and do not allow it to be handled in daylight or in strong gaslight.

The length of the exposure depends, in a great measure, on the developer used and the color of the print desired. As a basis for trial exposures, light a yard of magnesium ribbon, hold it six inches from the negative and keep it continually on the move. When actually making prints arrange the frames five or six at a time in a semicircle, and burn the magnesium at a point equidistant from them all. This will save both time and money.

Quinol gives tones ranging from red brown to greenish grey, according to the strength of the developer, and the time taken in developing. If the bath is strong and its action rapid, there will be a tendency towards green, but if it is weak and slow, we may expect a brownish print. A good formula is:

Quinol	1½ grs.
Soda Sulphite	6 "
Soda, caustic	2½ "
Water	1 oz.

Another useful formula is

Water	10 ozs.
Gallic acid solution (concent)	10 "
Sodium acetate	½ "
Fish glue	1½ "

The last ingredient is included to arrest the decomposition of the gallic acid. Prints that develop in this solution in one minute are a fine brown, while those that take double the time are a pleasing greenish black. Vigorous negatives only are satisfactory with this formula. By lengthening the exposure and substituting potassium oxalate or sodium or potassium tartrate for the sodium acetate, warmer tones may be secured. No previous washing is required with this bath; remove the prints as the shadows begin to blacken, and fix after a very brief and hasty rinse.

Chestnut prints are obtainable with pyro 15 grains, glacial acetic acid 25 minims, alcohol (90 per cent solution) ½ oz., water 9 ozs.

Violet tones of a very pleasing nature result from developing with pyrocatechin 2 grains, sodium acetate 10 grains, and water 20 ozs., followed by immersion in any ordinary combined bath, without intermediate washing. Pyro developed prints also become violet when placed in the combined bath.

Except where otherwise stated the undeveloped picture must be bathed for five minutes in a solution of potassium iodide 6 grains and water 1 oz. Many workers use a bromide instead of the iodide, but the latter facilitates a greater range of colors.

The various steps are thus summed up as (*a*) printing, (*b*) bathing in iodide, (*c*) washing, (*d*) developing, (*e*) rinsing, (*f*) fixing, and (*g*) prolonged washing. As a precaution against acidity of the hypo solution, it is well to pass the prints quickly through a bath of soda sulphite previous to fixing.

Whenever the color of a developed print is considered unsatisfactory, toning should be resorted to. The combined bath gives purer whites than the separate ones, but if we cannot reconcile ourselves to its use it will be well to fix before toning, and wash plentifully between. Patchiness is the outcome of insufficient washing.

Negatives that have thin or dense areas are unsuitable. With them forcing must be practised, and double tones nearly always result.

The colors to be obtained with this method of working are by no means vivid. On a semi-rough paper the effects of the various greens, drabs and browns will be highly suitable for winter landscapes, and in all those cases where minuteness of detail has been suppressed. Readers who have grown tired of the never-varying tone of bromides will find the foregoing hints of some value. Almost any brand of paper will do, but there are just a few kinds specially labelled by the makers as unsuitab.e. These must be guarded against.

In conclusion, it may be well to add that magnesium is selected as the illuminant solely on account of its convenience. Prints exposed to gas or daylight are equally suitable.—Photographic Monthly.

Water, though colorless when in small quantities, is blue like the atmosphere when viewed in mass.

USE OF DEVELOPING PAPERS.

C. H. CLAUDY.

I. Contact Printing with the Slower Papers.

There are certain things about the use of developing papers which are common to all instruction books. There are other things which are left out of many of these manuals, or included only partially. The things that are left out are usually the things the beginner most needs to know; they are le't out, presumably, for lack of space, or because the manufacturer dislikes admitting that there is anything which his paper lacks in the line of perfection, or which cannot be done with it.

Now it must be understood that these three papers are more for the beginner than the advanced amateur, and that no attempt is being made to tell anything brand new. But they are written from personal experience not only with my own troubles when I was a beginner, but from knowledge of the troubles of a somewhat large circle of photographic acquaintances who have also tried and failed and wasted paper by the box and so won their way to success.

In this present paper I shall confine my attention mostly to contract printing with the slower papers. In the second paper I shall undertake to speak of development and fixing and after processes, and the third paper will be devoted to the faster or bromide papers.

For convenience and because it is the largest of the family I am going to hang my remarks in this paper on Velox. Personally I have had more satisfaction with this brand than with others, but I am not saying that there are not other good brands. If a man can work Velox he can work any developing out paper of similar speed. Not because Velox is the most difficult but because it is made in so many surfaces and varieties that a thorough knowledge of it gives a knowledge of all.

In the first place then, for average negatives, for thick negatives and for thin ones full of contrast, use the special emulsion; if another paper than Velox, get the "soft" grade. Most of these papers are made in two grades one soft, the other the contrasty. But the soft grade is the one to employ nine times out of ten—the tenth time the regular grade or hard paper is most useful, but its employment the other nine times is fatal. I do not think enough stress is laid on this in the books and advertisements relating to these papers, hence I want to emphasize it.

In the second place, do not bother with any contraption for printing. Don't buy yourself a neat little wire and metal frame with a gas jet at one end and a rack for the frame at the other. It is money wasted. Don't make a light box. That limits you. But if you have a dark room and gas, get yourself a gas jet that can stand on the table or work bench and provide yourself with a weight or block of iron or lead. One of the great charms of the developing paper is the facility it affords for variations in prints, due to the different distances the frame is from the light and the various angles at which it may be held. A printing device or a printing box in a large measure prevents the full use of this feature.

In making any print, for a certain length of time of exposure, you must consider that you are using so many light units. If you halve the time you have halved the units; if you double the time, you have doubled the units. But if you change the distance of the frame from the light by a divisor or multiple of that distance, you change the number of the units the paper receives by a root or a power. Does that seem dreadfully complicated? It isn't in practice. Suppose that you find a certain negative gives, with a certain brand of paper, the kind of print you want at one foot from the light in one minute. If you make a second print, removing the frame to a distance of two feet from the light, you must give not two minutes but four minutes in order to have as full an exposure. The intensity of light diminishes with the square of the distance; that is, at twice as far the light is four times as slow; at three times as far, it is nine times as slow; at four times as far it sixteen times as slow, and so on. Consequently, if you know the exposure for a given light at a given distance, you can find it for any other distance by finding out the square of that distance and multiplying that by the first exposure.

Now the reason all prints are not made at one distance is that the further away from a light you hold a negative, the more opaque the high lights become in proportion to the shadows, and consequently the greater contrast secured in the print. Hold any negative two inches from a gas flame, and then two feet, and notice that you see the flame clearly enough through the thin parts in both cases, but that a decided difference is apparent in the looks of the flame through the high lights. In other words, a certain penetrative power of the light is used up in getting through the negative—what is left does the printing. This penetrative power is stronger close to the flame than far away from it. Therefore, if you have a flat negative, print far away from the light; if you have a contrasty negative, print close to the light.

If your negative is uneven and one side will print too fast or too contrasty—slant the printing frame on the bench so that one end or one side is closer to the light than the other. What is the block of metal for?

So that when you wish to make more than one print from the same negative, you can mark the place for the frame on the bench once the proper location has been determined, then by setting the frame against the block the second and other successive times, the same distance and angle is secured, and if the time given be the same the prints must be duplicates.

If you have mastered these few points you can proceed with your printing in the certainty that you will get results. You must eypect to spoil your paper before you get the hang of exposing. To spoil as little as possible, get a couple of dozen small sheets--say four by fives—even if printing large negatives, or cut some large sheets in strips. Make test exposures by exposing a strip at a time—the first for half a minute at one foot, the next for a whole minute, etc., or, if a very thin negative, the first for five seconds, the next for ten, etc. Develop, and note whether the whites are clear and the shadows dark, or whether the print is grey and muddy, or light and washed out, or black all over. The first means a correct exposure. The grey and muddy print is too long exposure, too short development—the washed out print is too little exposure, the black one over exposure. Instructions as to the way to develop belong to the next paper so for your tests follow the maker's directions.

If you stand across the room and put the paper in the frame on the negative in the shade of your own body, you will be perfectly safe. Suppose the correct exposure is half a minute at one foot; at eight feet the proper exposure would be thirty-two minutes, and in the shade of your body it might be three hours! Consequently the light which hits the paper while being transferred from package to frame amounts to nothing.

The sensitive side of the paper is the side that curls in. If the paper is moist from humidity, it will not curl. It is the side that tastes sweet—it is the whiter side of the paper. Laying two sheets side by side, one front up and the other back up, you can easily see which is which by the color. All such paper comes packed with the sensitive side all facing the same way with sometimes an exception in the last sheet which faces in.

Don't handle the sensitive side. Finger marks show in development, the oils from the fingers preventing the developer from taking hold. Handle small sheets by the edges, large ones by taking hold of as little of the paper near the edge as possible.

Get yourself a box, either wooden or pasteboard, with a hinged lid. Put your unexposed paper in this, face down. It is very inconvenient to take one sheet from the package when doing printing, and most easy to get it from the box, letting the lid fall into place when that one sheet is extracted. Develop each print as made, at first. When you get expert it is easier to do all the printing at once and then all the developing, but at first development should immediately follow exposure in order that errors of exposure may be seen and noted at the time.

A watch lying face up near the light should be used for timing unless you have one of those new dark room clocks, which ought to be very convenient. As a matter of safety I use a dollar watch for this purpose instead of my cherished pocket time piece, because I do not think the occasional slop of developer or fixing bath which gets on the work bench is good for it.

There is one more point in printing which deserves consideration. That is the facility for "dodging" the print. If you have a slow printing negative to do in solio and platinum, you know what hard work it is to vary results by waving a piece of cardboard between the negative and the sun for ten or fifteen minutes. With a gas light paper which produces a print in a few seconds, however, such dodging is a pleasure instead of work. Use heavy paper or cardboard, and put the side or edge of the negative to be dodged at the top—leaving that part which is to be continuously exposed at the bottom—when the frame is stood on edge. Do the dodging first.

Keep the paper or cardboard moving gently in front of the part you wish to shade from too much exposure and finish up by making the exposure of the entire negative. This way is preferable to dodging last, as any join in the dodging is less likely to show if a subsequent exposure covers the work. By this simple means an obdurate sky may be made to print out beautifully or a too thin face held back. In dodging a face alone, stick a hat pin into the edge of a small circle of cardboard and manipulate it so that the shadows of the hat pin do not fall in the same place all the time.

For learning, I would advocate the use of a smooth paper—such as special portrait Velox, or special Carbon, which is a semi-matte. If you can manage these you can manage the rough papers without any trouble and the glossy surfaces you will not want to bother with until you are an expert.

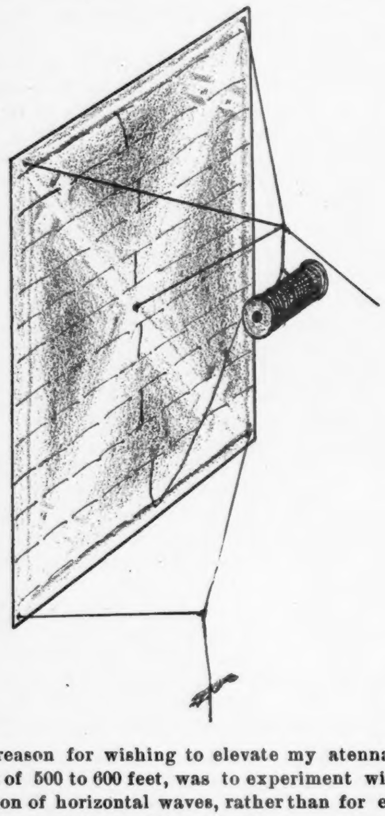
Lastly, do not be discouraged if your first end in disaster. I have keen recollections of spoiling two dozen sheets to get one passable print the first time I used the paper, and my troubles all disappeared once I was able to correlate correct exposure, proper development, with proper manipulation. Of course printing is in a way bound up with the process of development, and in the next paper I shall revert to this part of the subject, but the points given above are important enough in themselves to demand close attention from the beginner without reference at all to subsequent processes required to make a print.—"Photographic Times."

The great inequalities of the earth's surface are the result of unequal radial descent of the surface due to contraction brought about by cooling. Mountains represent portions of the exterior where it has been thickened by abundant sediment and then exposed to lateral crushing with proportionate upswelling.

KITES FOR ELEVATING WIRELESS AERIALS.

OSCAR N. DAME.

In many instances amateurs are not able to erect poles suitable for the elevation of aerial wires, and while light wire strung from insulators placed on trees has served the purpose temporarily, a very efficient way to erect the antenna is by means of the kite. In some of my experiments I utilized the square kite because of its large surface. One objection to the square kite is its occasional unsteadiness, whereas the box kite "stays put" when properly handled. But I found that the flat kite could be specially designed so as to be very applicable to my experiments, and the cost of construction was less than half that of a box kite; also the entire time consumed in building was much less.



My reason for wishing to elevate my atenna to a height of 500 to 600 feet, was to experiment with the radiation of horizontal waves, rather than for experiments in receiving, and I required as many square feet of radiating surface as could be controlled handily with ordinary manila twine. It must not be assumed, however, that the flat kite is superior to the box kite for general purposes of elevation, as elaborate experiments by both the War Department and the Smithsonian Institution have repeatedly proved the superiority of the box kite.

There had long been a diversity of opinions as to the sending distance of small spark coils, and also as to the superiority of a plate atennæ over the harp form consisting of many fine wires, or a single wire. Researches abroad tend to show that a metallic plate properly elevated will send waves a greater distance than any other kind of aerial. To disprove this theory prompted me to construct the kite described in this article, and I hope every wireless enthusiast will try the experiment in the field as soon as convenient.

The flat or square kite is made of two light but strong sticks fastened together like a cross or X. Nearly every boy has made one or more of these kites with varying results, but I will go into the details quite specifically so every amateur will meet with perfect success.

First procure two strips of spruce free from knots and splints, 1½ in. wide by ¾ thick, and 5 ft. long. Measure to the center of each piece, and at this point which is 2½ feet from the end, fasten the two by winding with fine, strong wire. With four staples, a piece of No. 18 copper or iron wire is run from end to end of the strips and there fastened. About this wire the cloth covering of the kite is to be glued. In fastening this wire the frame should not be made a perfect square, but one-third longer than its width.

Sufficient unbleached cotton cloth of extra width is procured, or what is better, some Holland such as is used in the manufacture of window curtains. This latter is more expensive than cotton, but has a finer texture for kite purposes. An old curtain is obtainable in nearly every home. A piece of the goods is cut 3 in. larger all the way round than the kite frame, and then fastened to the wire frame with good fish glue, the cloth being lapped about the wire on all sides. The cloth is not stuck to the wooden pieces, but on the back side of the kite strips of stout cloth may be pasted over the strips near the ends.

The slings of this kite are of heavy twine. It will be noticed that the upper V piece of twine is of just the length to reach to the center of the kite, and the twine from the center which is fastened to the V piece is as long as from the center to the top edge of the kite. If these proportions are not followed, the kite will not fly accurately, but tend to bob and dive beyond control with every little variation of the wind. A short loop is fastened at the lower end of the kite, to which is affixed the tail. This tail is of the rag pattern, and for this size of kite should be made of four inch strips of old cotton cloth fastened together. The

tail length should be in the vicinity of 35 feet. A bob or tassel of short pieces of cloth, weighing two pounds, will be required on the end of the tail. Additional weight may be affixed to the bob when a heavy wind demands.

I might say right here that there is no reason except that of durability, why this kite cannot be made of brown manila paper or newspaper, for that matter. Most kites fall once or twice before being flown successfully, and for this reason cloth is used.

About sixteen square feet of tin foil of thinnest texture, such as is used in making spare coil condensers, is next procured, and the outer or front surface of the kite covered. This foil comes in long strips 5 in. wide and weighs little more than paper of the same size. The foil is stuck on with glue. Some very fine bare copper wire is then threaded on a needle and very coarse stitches placed all across the surface of the kite. This answers to connect all the foil strips together metalically, and also helps hold the foil to the kite. Some more bare copper wire is fastened through the covering of the kite and foil at the center cord, and wound about the cord to the point where the flying string is affixed.

The kite string is stout hemp twine, purchasable at any hardware dealer's for 15 cents per ball. The distance above the earth the kite is to be flown must be roughly estimated, and considerably more than that length of No. 36 copper wire, insulated or bare, wound on a reel or spool. The outer end of this wire is affixed to the fine copper wire coming from the kite, and the spool itself fastened to the bottom of the kite by means of some thin cotton thread or rotten string. After the kite has been elevated a few minutes, the spool may be released by jerking the kite string. This wire, after falling to earth, is then run along in parallel with the flying string until it reaches the operator, where connection may be made with the sending apparatus of the wireless outfit.

As a result of experiments with my kite, numerous conclusions were reached. First of importance was the fact that with an electrolytic receiver at a distant point, very little spark coil discharge gave excellent results, whereas the same coil attached to a single aerial wire was very erratic. It would seem, therefore, that experiments with kites of this type will establish what foreign experimentalists have long believed to be true, that large capacities at considerable height require but very small transmitting energy.

COST OF ELECTRIC LIGHTING.

They are having an electrical exhibition in London, and in connection with this have secured prominent electrical men to make public lectures. A number of these have been of particular interest to the public, one especially so, since it touched upon the use of electric lights in the home. This lecture was delivered by Mr. James Swinburne, past-president of the Institution of Electrical Engineers of Great Britain, and a past-master of the lecturer's platform. Mr. Swinburne never has difficulty in holding the attention of his hearers. He can take what, to many, would seem a dull subject and turn it so that every one listens earnestly, and yet he always has some useful message to deliver and he manages to deliver it in such a way as to impress it upon the minds of those who hear him.

In his lecture Mr. Swinburne told his audience the interesting story of the development of the incandescent lamp. Then he got down to business and showed how much superior this lamp is to the older forms of illumination in which a flame is employed. It not only gives a better light, is safer and can be arranged so as to give a better illumination but, everything considered, is cheaper. Perhaps this would not appear true if one compared merely the cost of gas with the cost of electrical energy; and perhaps the comparison might seem still less in favor of electricity if, as is frequently done, one changes over from gas to electricity and then compares the cost of a satisfactory lighting by a later method with the unsatisfactory lighting by gas which preceded. Under such conditions it would be an exceptional case in which the cost for the gas alone was not less than that for electricity.

But this is only one way of looking at it. In fact, to get the two systems on a fair basis, every item should be considered. The estimates should be made for an equal illumination in each case. The relative risks must be determined as closely as can be, and the effect on the house of the two methods must not be overlooked. As was shown by Mr. Swinburne, the gas flame assists very materially in spoiling the decorations of a house, as well as increasing the dust and dirt. It seems that it is necessary to redecorate a London house about once every four years when gas is used; but when electricity is adopted, the house need be decorated not oftener than once in five or six years; and this is an underestimate. In fact, Mr. Swinburne is convinced that, in the long run, the electric light is cheaper than gas, even if the latter be free. This was an eminently satisfactory conclusion for the lecturer. Unfortunately, it is more difficult to persuade the possible consumer of the economy of electric lights. It is easier to work it out on the blackboard than it is to drive it through the consumer's pate—a work, by the way, to which the electric-lighting companies are devoting not a little time and energy just now. Mr. Swinburne has, however, brought out a new and interesting phase of the lighting question, of which the companies will doubtless make good use. It is one which has received almost no attention heretofore.

The chief use of copper is for electrical purposes, especially for dynamos and motors. Copper drawn into wire is employed for submarine cables, long distance telephone and telegraph lines, light and power service, etc.

AMATEUR WORK.

DRAPER PUBLISHING CO., Publishers,

88 Broad St., Room 522, Boston, Mass.

A Monthly Magazine of the Useful Arts and Sciences. Published on the first of each month for the benefit and instruction of the amateur worker.

Subscription rates for the United States, Canada, Mexico, Cuba, Porto Rico, $1.00 per year.

Single copies of back numbers, 10 cents each.

TO ADVERTISERS.

New advertisments, or changes, intended for a particular issue, must be received at this office on or before the 10th. of the previous month.

Entered at the Post Office, Boston, as second class mail matter, Jan. 14, 1902.

OCTOBER, 1906.

The following awards have been made in the editorial suggestion offer announced in the June number:

First, Chas. C. Trump, Syracuse, N. Y.

Second, M. M. Hunting, Dayton, Ohio.

Third, Ralph L. Bugbee, Methuen, Mass.

Additional awards have also been made as follows:

Jacob Daniel, Philadelphia, Pa.; W. C. Mansfield, Cleveland, Ohio; H. W. Hewest, Dartmouth, N. S.; Frank O. Potter, St. Louis, Mo.; A. Talluraphus, Omaha, Neb.; Harry E. Staples, Providence, R. I.; Edward M. Boggs, Oakland, Cal.; James B. Reed, St. Paul, Minn.: Harry T. Demarest, Warwick, N. Y.

We would again express our sincere thanks for the numerous responses to our offer, and the many valuable suggestions received. We shall utilize these ideas as far as possible, and as soon as arrangements can be made therefor. Owing to lack of space it will not be possible to publish the papers received, although many of them are of considerable general interest.

With the approach of long evenings and cool weather, the thought of the amateur mechanic naturally inclines towards the work which has been held in abeyance during the summer. Many of our readers have already formed plans for a systematic course of study or work, but many others have not. The importance of pursuing some line of study or work, which may at the same time furnish much pleasure, cannot be too strongly emphasized. "Work" is the watchword of success, and he who would achieve success must utilize his time to the best advantage.

We are too much inclined to think that work means drudgery, but this is true only when the worker has no interest in his occupation, or when that occupation is so mechanical as to require no mental effort by the worker. We should, therefore, give careful thought to both our work and our pleasure, and our constant efforts should be directed towards fitting ourselves for and engaging in the work for which nature has best endowed us.

It is rarely an easy matter to reach a desired position quickly, but drifting along without purpose will not bring it. Well laid plans, persistently followed, will accomplish much, and will in time become so interwoven into our mode of life and thought as to be of material assistance in accomplishing our aims.

With this number we complete the fifth year of this magazine. Our sincere thanks are given to the many who have assisted us with their subscriptions and in other helpful ways. We look forward to the next five years with much encouragement, and the plans now under way will, we trust, make the magazine even more helpful and interesting than in the past. The many letters expressing the appreciation of the writers, which we are constantly receiving, are but a spur to increased effort on our part.

Ozone is a colorless gas like oxygen, having a peculiar odor like that of air and a chemical activity. The density of ozone is one and one-half times that of oxygen and is changed into oxygen only at a higher temperature.

ECONOMICAL METHOD OF CONSTRUCTING INDUCTION COILS.

W. S. DENT AND L. B. WEEKS.

The induction coil is indispensable to the experimenter in wireless telegraphy, radiography, high frequency work and, in fact, all work for which a high tension current is needed. On account of the high prices usually charged for coils or for the materials generally used in making them, many are unable to obtain this most useful apparatus. It is the purpose of this article to describe a method of building coils which requires far cheaper materials, takes much less time to construct and yet produces a coil distinctly better than the average. The total cost of making a 6-in. coil to be used with an electrolytic interrupter, that is, without condenser and mechanical break, is somewhat under twenty dollars. If the builder does not care for exterior finish, the cost would be considerably less.

The only expensive tool used in the method is a lathe which can cut sixty threads, both right and left hand, to the inch, and which swings, or can be made to swing, by blocking up the head and tail stocks, 10 in. over the carriage. If such a lathe is not at hand, a substitute can readily be rigged up with the expenditure of a dollar or two and a little ingenuity.

As the exact dimensions of the rest of the coil are dependent upon those of the secondary, the construction of the secondary will be taken up first. For this the following material will be needed:

12 pieces ⅛-in. sheet fiber, 7 x 7 in.

12 strips medium unglazed paper (0.018 in. thick, 2¼ x 22 in.)

600 strips thin unglazed paper (0.0045 in. thick, 2 x 24 in.)

6 pounds bare No. 36 B. & S. copper wire on a spool.

6 ft. 3-16 in. round fiber rod.

1 ft. ⅜ in. round fiber rod.

100 ft. bare No. 25 B. & S. copper wire.

20 pounds best white paraffine.

A form constructed of pine according to Fig 1.

Thick shellac varnish.

Other materials as mentioned below.

Wind two strips of the medium paper on the mandrel of the form, fastening down the second with thick shellac varnish. Cut holes in the center of two of the 7-in. fiber squares so that it will fit over the paper as tightly as possible; put on the form heads and screw a fiber square to each of them. Drill a hole diagonally through the paper next the core; slip through a foot of cable, made of half a dozen strands of bare No. 25 wire; take one turn of it around the paper on the mandrel; splice the No. 36 wire to the cable and the section is ready to wind. See Fig. 2 for the relative positions of the parts. The spool of wire should be supported so as to unwind easily. From the spool the wire goes under a rod to increase and steady the tension, then over the V-shaped guide, constructed according to Fig. 3, in the tool post of the lathe and finally is wound on the section which is chucked in the lathe—the gears being set for cutting 60 threads to the inch.

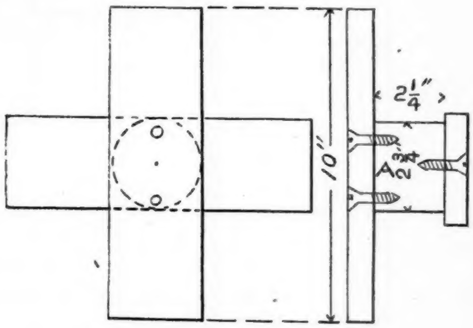


FIG. 1.

When the lathe is started, the wire will wind evenly upon the mandrel and each turn will be one sixtieth of an inch from the one next to it. Begin widing one-fourth of an inch from the inside of one head and wind to the same distance from the other head. Reverse the direction of the carriage; slip the end of a piece of thin two-inch paper, long enough to make one layer with a lap of about one inch, under the wire; wind back over the first layer of wire, letting the paper wind on with the wire. Reverse the carriage again, slip in paper between layers and continue winding in this manner until 130 layers of wire have been put on.

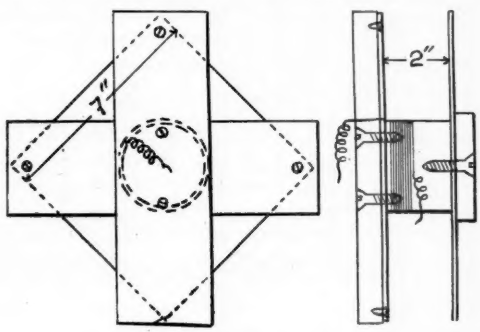


FIG. 2.

This will make a diameter of about 5¾ in. Finish the section by attaching a piece of cable and bringing the wire out by drilling through the coil head.

See Fig. 4 for relative positions of ends. Put a layer of paper and one of thread spaced by the winder, over all. Take the section from the form and run a bolt with nuts made of the fiber rods through each corner, as in Fig. 4. Bake for half an hour at a tem-

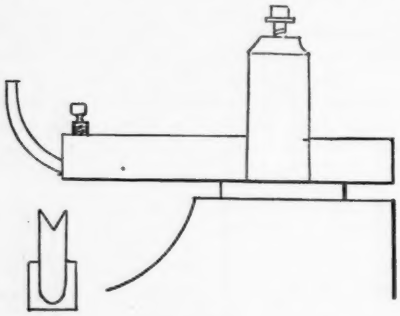


FIG. 3.

perature of 120–130° C.; immerse immediately in melted paraffine until all air bubbles cease to rise, the paraffine being kept at a temperature not exceeding 120° C. When the bubbling ceases, let the paraffine cool down until it is nearly hard; take the section out and brush off the superflous wax.

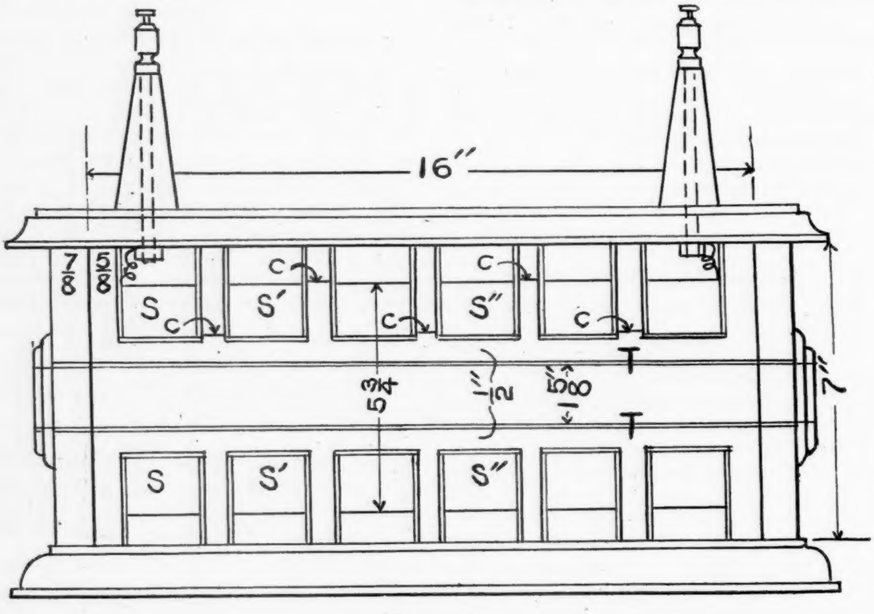


FIGURE 5.

Build six sections in this manner, winding in the same direction and bringing the ends out in the same way. Test each for continuity of the wire. When the six sections are complete and after they have been saturated with the melted paraffine, place them in a box (7 in. inside breadth, other dimensions according to Fig. 5) in the position shown in Fig 5. Arrange the sections so that the holes will be concentric with the fiber tube shown in the figure. Connect the terminal wires of the sections as shown in Fig. 5, and test the

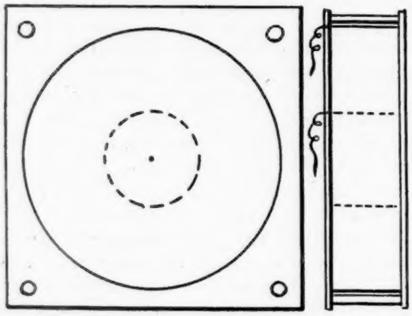


FIG. 4.

whole series for continuity with a high resistance voltmeter. If there is no break, continue with the construction.

Place the fiber tube, shown in Fig. 5, in position in the box and make the bottom and sides air tight with putty. Melt about 15 pounds of paraffine, being careful not to let the temperature exceed 120° C. (248° F.) aad fill the box from the top, pouring in more paraffine as contraction takes place. Attach the secondary terminals to the rods leading through the hard rubber

posts to the binding screws, shown in Fig. 5; screw down the lid and the secondary is complete.

The core is made by packing a fiber tube 18 in. long by 1 in. inside diameter with one-sixteenth inch walls, full of No. 18 B. W. G. iron wire, specially annealed for coil cores. The ordinary annealed iron wire is not suitable. The core is wound with two layers of No. 12 B. S. single silk-covered copper wires to about one-half inch from each end. The space allowed for the primary is so closely calculated that it is necessary to wind the layers separately and in the same direction. This method also has the advantage of allowing either series or parallel connections of the layers. When the primary is completed, soak it for fifteen minutes in hot paraffine; let the wax cool until it is nearly hard; then remove and scrape off the superfluous wax. Slip the primary into place in the tube of the secondary, connect its terminals to binding posts and the coil is ready for use.

The principal advantages offered by the method of construction above described are as follows:

1. The use of paraffine as an insulator between the primary and secondary coils, which was found to be a very satisfactory plan of insulation, though by no means essential to the successful building of a coil with bare wire.

2. The substitution of bare for insulated wire, which reduces the cost — insulated wire being about five times more costly than bare—saves in the coil building, and is much more convenient in that it can be handled with less care.

We have treated a coil, according to the above method, on a Wehnelt electrolytic interrupter run on a 110-volt lighting circuit up to 25 amperes with no unsatisfactory results other than the partial melting of the wax in the primary. The longest sparking distance tried was 7 in., though, judging from the thickness of the spark, the distance might have been considerably greater without the least damage to the insulation of the secondary. We hope that others may have as much satisfaction from the use of a coil built according to this description as we have had." —Elect'l World."

Editorial Note.—By adding another feed tube on the tool post, a thin, strong thread could be wound between the turns of wire serving to better insulate the wire, as well as give a more even surface to the several layers. If this be done the layers could be basted with a hot paraffine wax, applied with a brush, and the subsequent baking would make the whole section well insulated.

If a battery current be used to supply the current the condenser should have about 4000 square inches of foil area. This would divide nicely into 100 sheets 8 x 5 in. and should be made up in four sections. A mechanical or motor operated interruptor would be suitable for this coil.

Owing to the difficulty of obtaining the material required to make the coil in the manner described, by retail purchasers, quotations are now being obtained from manufacturers and the necessary parts will be offered as premiums as soon as possible.

EXPERIMENTS IN PRESERVING MEAT.

In a report by the Italian Minister of Agriculture on the subject of refrigerating in Italy, Mancini gives some interesting results obtained by the Craveri process for preserving meat—a process which was much discussed some months ago, but of which a more definite idea can now be formed, since a series of experiments have been conducted under the direction of a number of university professors.

The Craveri method would seem to have solved the problem hitherto unsolved—of preserving meat in a form fit to be eaten by means of chemical treatment. Excluding for hygienic reasons ordinary antiseptics, and recognizing as insufficient for practical purposes the usual method of salting, Craveri resorts to injection into the veins of slaughtered animals, from which the blood has been drained, of a solution of 100 parts of water, 25 of kitchen salt and 4 of acetic acid; in other words, of a solution of a mixture of substances as are found normally in our bodies and which form part of our nourishment. The solution is injected to the amount of one tenth of the weight of the living animal.

Prof. Brusaferro, of Turin, experimented upon two animals, a sheep and a calf; the two carcases were hung in a subterranean room for 75 days, at a temperature of 16° C. (about 61° F). After this time they were skinned, dressed and cut up. The heart, brains, liver and intestines seemed somewhat macerated but were normal in appearance. The fat beneath the skin was perfectly preserved, the flesh appearing bright red, moist, and giving out an agreeable, slightly acid odor. In no part was there any trace of putrefaction, even incipient. This meat boiled produced an excellent broth, resembling in every particular that obtained from fresh meat. Roasted it was tender and even tasted better than ordinary meat, was digestible and nutritious.

As a result of these and other experiments, Prof. Brusaferro declares it as his opinion that the Cravari method promises great advantages over others. The other professors engaged in the experiments came to exactly the same conclusions. Submitted to a bacteoriological examination, the meat proved free from bactyria; in the long period of preservation given, the beginning of dissolution was noticed in the visceral and muscular tissues, but without the production of any toxic principle whatever.

Each watch movement requires from 30 to 50 screws. By the earlier methods a skilled workman could make 700 to 1200 screws daily. Automatic machines now produce from 4000 to 10,000 screws per day, and one man can operate six machines.

FUNCTIONS OF A D-SLIDE VALVE.

Notwithstanding the fact that the D-slide valve is almost as old as the steam engine itself, there are many engineers who still have only a hazy idea of its functions. While many engines are now equipped with valves differing very materially from the D-slide valve form, yet the method of steam distribution in a cylinder can best be explained by referring to the action of a slide valve because it embodies all the functions of other valves in the shape of a simple piece of iron of the D-form.

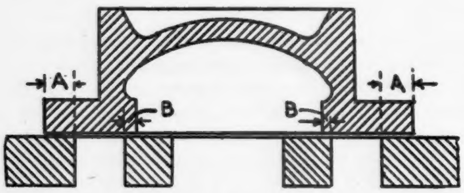


FIG. 1.

There are five principal functions which a slide valve must perform in order that the engine may do efficient work: First, it must admit steam into only one end of the cylinder at the same time. Secondly, it must cover the steam ports so as not to permit the passage of steam through both steam ports at the same time. Third, it must allow the steam to escape from one end of the cylinder before it is admitted at the other end, so as to give the steam that is to be exhausted time to escape before the piston commences the return stroke. Fourth, it must not permit live steam to enter the exhaust port direct from the steam chest. Fifth, it must close each steam port on the steam side before it is opened on the exhaust side, so that the expansive force of steam may be utilized.

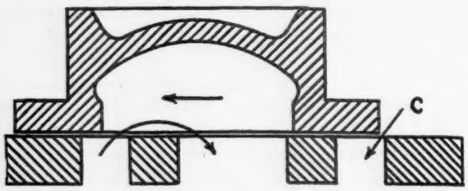


FIG. 2.

The general construction of the D-slide valve is shown in Fig. 1 and represents the valve in its central position. The two terms, steam lap and exhaust lap, can here be explained. The steam lap is that portion of the valve which overlaps the steam ports when the valve stands in its central position. This is shown at *A A*, Fig. 1. The exhaust lap, or inside lap, is that portion of the valve which overlaps the the two bridges of the valve seat when the valve is in its mid-position. This is shown at *B B*, Fig. 1. The purpose of steam lap is to allow the steam to be used expansively in the cylinder, and the purpose of exhaust lap is to delay the release of the steam and to hasten compression. If a valve had no steam or outside lap, it would admit steam throughout the whole stroke and another effect would be a late exhaust, by which is meant that the exhaust would occur at one end of the cylinder at practically the same moment that admission occurred at the other end.

When the engine is on center, the valve is usually moved on its valve stem, or the angle of advance is adjusted until the port just begins to open. This amount of port opening, as shown at *C*, Fig. 2, is called the lead, and all successful engines must have some little lead. The object of giving a valve lead is because the steam port should be slightly opened for the admission of live steam just before the piston reaches the end of its stroke in order that there may be a cushion of steam to receive the piston and reverse its motion at the end of the stroke.

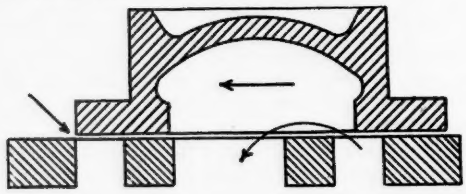


FIG. 3.

When the valve is cutting off, it takes the position as shown in Fig. 3. The valve is just covering the port, as shown by the arrow. Compression begins when the exhaust port is closed, before the piston reaches the end of the stroke. A small portion of the steam is thus retained in the cylinder to be compressed by the advancing piston, which thus meets with a slight cushion at the end of the stroke and all shock and jar are thus prevented. The point of compression begins when the inside or exhaust edge of valve has closed the steam port, as shown in Fig. 4, assuming the valve to be travelling in the direction indicated by the arrow.

Release occurs when the exhaust edge of the valve opens the steam port and allows the steam to escape into the exhaust port. This is shown in Fig. 5.

The travel of the valve is the distance through which the valve moves, sometimes called its stroke. This depends upon the eccentricity of the engine. The valve should always move enough to open the port its full width, and it is generally better to allow it to move further. The amount the valve travels after the steam port is wide open is called over-travel and is indicated by the distance OT in Fig. 6.

Unless the above principles of the valve are understood, trouble will always be experienced when setting a valve. It should also be understood what results are obtained by adjusting the position of the eccentric. When the valve is direct-connected, the eccentric will be ahead of the crank by an amount equal to 90° plus a small angle called the angular advance. When a reversing rocker is used, the eccentric will be diametrically opposite this position, so that it will have to be moved around 180° and will follow instead of lead

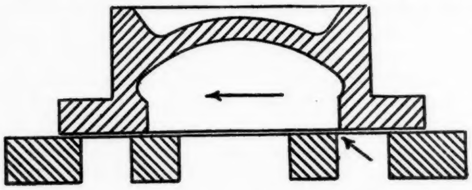


Fig. 4.

the crank. Shifting the eccentric ahead has the effect of making all the events of the stroke come earlier, and moving it backwards has the effect of retarding the events, such as cut-off, release, compression and admission. Lengthening or shortening the valve stem cannot hasten or retard the action of the valve, and its only value is to make the lead or cut-off, as the case may be, greater on one end than on the other. The general practice is to set the valve so that it will have equal lead.

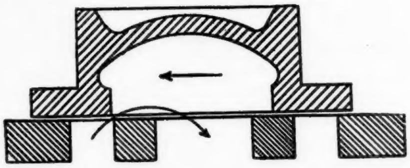


Fig. 5.

To set the valve, put the engine on the center, remove the steam chest cover, so as to bring the valve into view and adjust the eccentric to about the right position to make the engine turn in the direction desired. Now make the length of the valve spindle such that the valve will have the requisite amount of lead. This amount will depend upon the size and speed of the engine, but about 1-16 of an inch may be tried. Turn the engine over on the other center and measure the lead at that end. If the lead does not measure the same as before, correct the diffierence by changing the eccentric to correct half the difference and changing the length of the valve stem to correct the other half of the difference. For instance, suppose that the lead was $\frac{1}{4}$ in. more on the head end than on the crank end. Lengthening the valve stem $\frac{1}{8}$ in. would make the valve open too soon at both the crank and head ends, and to correct this, the eccentric would make the valve have to be moved back far enough to take up the other $\frac{1}{8}$ in.

When it is not convenient to turn the engine over by hand, the valve may be set for equal lead as follows: To obtain the correct length of the valve stem, loosen the eccentric and turn it into each extreme position, measuring the total amount that the valve is open to

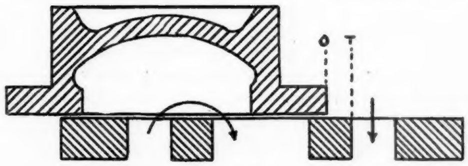


Fig. 6.

the steam ports in each case. Make the port opening equal for each end by changing the length of the valve stem. Now put the engine on center and move the eccentric around until the valve has a correct lead. This will determine the angular advance of the eccentric, and after fastening the eccentric in that position the valve will be set.—"The Practical Engineen."

TOWING WITH ELECTRIC LAUNCHES.

In a recent issue of our esteemed contemporary, the "Amican Shipbuilder," an interesting suggestion is made. It is said that since many of onr large coasting schooners are fitted with power apparatus for hoisting cargo, sails and pumping, and frequently are supplied with dynamos for lighting the vessel, that this power might be still further utilized by applying it to one or two suitable launches, which could be used for towing the vessel in calm weather and for shifting her berth in small harbors. Having plenty of power at hand, the launch could easily be hoisted out, the motor connected to the dynamo by means of an insulated cable, and the vessel towed at three or four knots. At four knots an hour in a dead calm a vessel would make ninety-six miles per day. and in this way the cost of the equipment would soon be made up in towage fees and in the saving of time.

This is a very interesting suggestion. Although we are not familiar with the amount of power required for this work, it sounds reasonable. If the launch were equipped with batteries it would be of considerable service to the vessel when she lay in a harbor. For this purpose the battery equipment need not be large. It would probably be well to have the motor as large as the electrical equipment of the vessel would stand, for since, when towing, it would draw its power directly from the dynamo, the small battery equipment would not limit its output. The outlay required for this launch should not be large, and it would be quickly repaid. Even if the vessel were able to make only two knots, in the course of a day nearly fifty miles would be covered, and she would possibly be carried beyond the calm. The suggestion embodies another instance of the flexibility of electric transmission, and is one well worth trying.

FREE ALCOHOL AND ITS NEW APPLICATIONS.

FREDERICK A. DRAPER.

After Jan. 1, 1907, no internal revenue tax will be imposed upon denaturized or undrinkable alcohol, and the indications are that after that date there will be a rapid and immense increase in its manufacture and uses. Under the conditions hitherto prevailing, 95 per cent proof alcohol has cost to profitably manufacture about 30 cents per gallon, and the internal revenue tax has been $2.20 per gallon, making the cost prohibitive to many lines of industry, and greatly limiting its uses.

Greatly enlarged consumption will follow the comparatively low price; new sources of raw material will be utilized for its manufacture, and the farming sections of the country will here find a new market for certain crops. It is estimated by Dr. Wiley, chief of the National Bureau of Chemistry, that from corn alcohol may be distilled at a cost of about 12 cents a gallon; from molasses 10 cents a gallon, from potatoes specially cultivated for the purpose, 9 cents a gallon.

Dr. Hanson, an expert of the Department of Agriculture, has secured seed from Europe of a variety of potato which grows to a size several times larger than the common edible potato and is capable of yielding a large quantity of alcohol. It is, however, too coarse for the table. Rusty or smutty grain, surplus fruit and vegetables, instead of being a loss to the farmer, will hereafter be turned into the still and supply the farmer with fuel for running an engine with which to saw wood, pump water, grind feed, churn butter, run a cream separator in the daytime and light the premises at night.

The pumping of water at low cost will make an important difference in the cultivation of farms in the arid regions of the country, as land can be irrigated without regard to the distance from petroleum, coal or wood. The sugar beet, which can be very easily grown on irrigated land, yields an abundance of alcohol which, as fuel for pumping machinery, would enable the irrigated area to be greatly extended.

As a fuel for the kitchen alcohol possesses many advantages, being odorless, non-explosive and clean. For lighting purposes, by means of the incandescent mantle lamp, it is excellent, but some inventive work will probably be advisable before it will be commonly used for either cooking or lighting.

It is not to be assumed, because no tax is to be levied, that alcohol can be manufactured by anyone who wishes. The temptation to omit the denaturizing part of its preparation would be too great to allow of its manufacture without proper supervision. The processes must still be conducted by properly licensed establishments where the addition of other fluids to make it undrinkable will be made. In all probability it will be necessary for farmers to organize and operate small distilleries on the co-operative or some other plan, special arrangements being made for those living in remote sections of the country.

As it is its application to the internal combustion motor which will be of most interest to readers of this magazine, it is well to state that but little reliable data is obtainable in this country upon which the designs of explosive engines can be based. Much has been done in Germany and France in the way of perfecting such engines, and the leading manufacturers will thoroughly investigate the results in these fields before catering to the home market. Even with such information as may be obtainable abroad, much experimenting will remain to be done, and new designs should be thoroughly investigated before being accepted.

It is of interest to understand the cause of the difficulties which confront the engine builder. The higher a liquid fuel is in carbon. the more readily will it explode under the heat of compression, while a fuel low in carbon but high in hydrogen, permits of high comcompression without generating excessive heat with combustion. A mixture of gasoline vapor and air may be exploded under low compression, but the customary pressure found in engines varies from 70 to 100 pounds.

With alcohol, however, another factor must be taken into consideration, and that is its affinity for water, so called pure alcohol "pure" alcohol carrying from four to six per cent of water. As water may readily be added, forming a complete mixture, adulteration with water will be easy and detection will be difficult. The boiling point of a mixture of 95 per cent. alcohol and 5 per cent water is 460° F., while a mixture one-half alcohol and one half water requires 930° to evaporate it, or over twice as high temperature.

The degree of purity of alcohol becomes important when we consider the means for vaporizing it. In all probability the solution to successful vaporization of commercial alcohol will be found in some method of utilizing the heat of the exhaust gases to heat the air feed before carrying it through the alcohol receptacle. The use of heated air in this connection will not entail a loss of power, because the evaporation of the alcohol will cause a sufficient loss of heat and contraction of volume to produce a mixture of relatively low temperture.

Referring again to the compression, it is evident that it must be proportionate to the grade of alcohol to be used, as the greater the quantity of water the higher must the compression be carried to secure suf-

ficiently rapid combustion.

Owing to structural conditions there is a limit to which this can be advantageously carried, and 150 pounds for 90 per cent alcohol, and 175 pounds for 75 per cent seem to be that limit. The necessity of using a fairly uniform grade of alcohol for a given engine is evident, although variations within reasonable limits will not seriously interfere with the proper working of an engine

The water contained in alcohol is not without its useful purposes, however, as it serves to take up much of the excessive heat due to combustion. Air cooled engines will probably be the rule in all except the very largest sizes, and the troubles of water cooling will be avoided. A lessened cost of manufacture should also follow unless the requirements of vaporization offset any saving from this source.

Some difficulty has been experienced in starting engines using alcohol as a fuel, gasoline or benzine being used to assist until sufficient heat has been developed to permit of alcohol alone. It is quite probable, also, that these fuels may be mixed with alcohol to provide fuel for existing engines, such a mixture having distinct advantages for such application.

From the foregoing it is evident that much experimental work remains to be done, before the alcohol engine can be considered as being sufficiently perfected to command an unquestioned position in the power world. How soon it will reach such a condition remains with the inventive abilities of manufacturers to determine. We shall know more about the success of their efforts by the time the additional distilleries have been equipped and have begun to put upon the market alcohol in sufficient quantity as to make it readily obtainable.

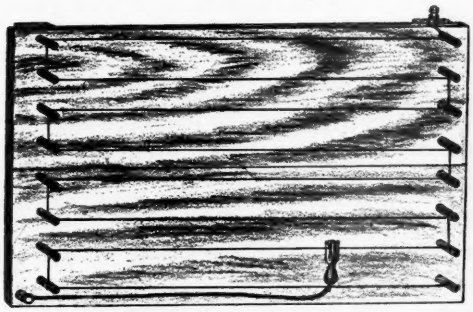
WIRELESS TUNING COIL.

W. C. HUTCHINSON.

To obtain the best results with wireless telegraphy apparatus it is necessary to have the sending-receiving stations tuned as near as possible to the same wave length. As considerable difference will always exist in the workings of coils of the same rated capacity, caused by variations in the rate of vibrations, strength of current, etc., some quick method of adjusting the receiving apparatus must be used, by means of which the wave detector can be made as sensitive as possible to the incoming waves. This is done in part by what is known as a tuning coil, and the one here described has the advantage of being shaped so that it can be fastened to the wall and, while convenient for use, is out of the way of the rest of the instruments which of necessity occupy considerable room and cannot be thus disposed of.

The materials required are: A base of well seasoned wood about 40 in. long, 15 in. wide and $\frac{7}{8}$ in. thick. Whitewood is excellent for the purpose, as it is easily obtained of the required width. Two cleats about 3 in. wide are fastened near each end at the back with $1\frac{1}{4}$ in. screws to prevent warping.

Several maple or birch dowel rods 1 in. diameter are then sawed into 12 pieces each 3 in. long. Shallow grooves are turned about $\frac{1}{4}$ in. from one end of each piece, and the ends smoothed off. Holes are then bored near the ends of the base, spaced $2\frac{1}{2}$ in. apart, to receive the pins, which are put in with glue.



The whole frame is then given two coats of shellac, and an additional coat in the grooves of the pins will be an advantage, as it improves the insulation. The wire is then strung back and forth over the pins, beginning at the top, where connection is made with the aerial wire, ending with one of the bottom pins, around which a full turn is taken and the end twisted around the main wire. The first pin to be used is either on the right or left side of the board, according as the coil is placed on one side or the other of the aerial, so as to make as direct a connection as possible. The length of wire in the coil is about 33 ft., which should be sufficient for an aerial not over 100 to 125 ft. high. The wire used should be the same gauge as that used for the aerial.

A clip for adjusting is made from two pieces of spring brass about $\frac{1}{4}$ in. wide and 1-32 in. thick, which are riveted or soldered to another piece of flat brass a trifle less in thickness than the diameter of the wire. The corners are then rounded off and a cover for one end is then made from a piece of hard rubber tubing, so that the clip may be adjusted without the possibility of shock. The wire connecting the clip to the wave detector may be a piece of flexible electric light wire, one strand only being used. It is best connected to the clip by means of a round head brass screw, which necessitates drilling and tapping a hole in the clip. If this is not convenient, the wire may be wound around the clip near the handle and then fastened by winding a strong thread over it, but the latter is not as good a joint, as the wire oxidizes and the wave impulses, which at best are quite feeble, will not pass as freely as if the screw fastening be used.

When water passes from the liquid to the solid state it expands to the amount of about 1-11th of its volume.

A WATER POWER BLOW PIPE.

M. M. HUNTING.

An apparatus for producing a blast for a small blow pipe by water power may be made in the following manner.

A piece of 4-in. iron pipe, 6 ft. long, is fitted with a cap at each end. About 1 in. below the cap at the upper end, drill and tap a hole and screw in a short piece of ⅜-in. pipe; *C*, Fig 1. At the other end, about the same distance from the cap, drill and tap a hole for a ½ in. pipe and screw in a short nipple to which may be attached the exhaust pipe 2½ in. long, with valve as shown at *B*, Fig 1.

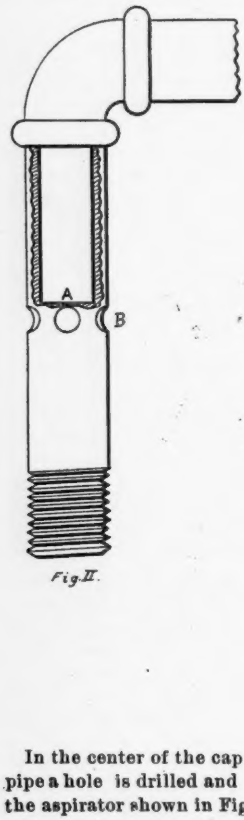


Fig. II.

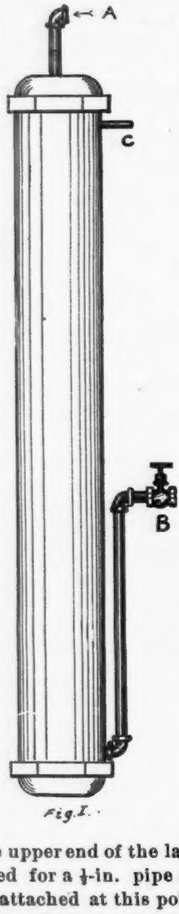


Fig. I.

In the center of the cap at the upper end of the large pipe a hole is drilled and tapped for a ½-in. pipe and the aspirator shown in Fig. 2 is attached at this point

The aspirator is made asfollows: In a piece of ½ in pipe 4 in. long and threaded on both ends, drill four ¼-in. holes, *B*, Fig. 2, at equal distances around the circumference, and at a line on the pipe equi-distant from the ends.

Into one end of this piece run a ½-in. tap so as to thread the inside of this pipe down to the point where the holes are drilled. Cut a thread 2 in. long on a piece of 3-in. pipe and screw it into the ½ in. piece until the end comes nearly down to the ¼-in. holes; *A*, Fig. 2. Saw off the other end flush with the end of the larger pipe.

An elbow may now be screwed on the upper end of the aspirator for convenience in attaching to the source of water supply. The lower end should be screwed tightly into the cap on the large pipe.

When a stream of water enters the aspirator at *A*, Fig. 1, it draws in the air through the four small holes. As the water rises in the large pipe the air is given a pressure and flows out of the small pipe *C*, Fig. 1. A rubber tube connects this pipe with the blow pipe.

The valve *B* may be connected with a waste pipe and should be partly closed so that the water may rise in the large pipe enough to give the air an even pressure. All threads should be well leaded before screwing together in order to secure air and water-tight joints.

WOOD MADE FROM PEAT.

Frequent attempts have been made to use peat as raw material for the manufacture of artificial wood. The material must, for this purpose, be fully reduced to a fibrous condition, so as to produce a mealy mass. This mixture is mixed with an emulsion of plaster and water, and is subjected for considerable time to heavy hydraulic pressure in molds, then artificially dried, polished and oiled, painted or varnished.

Another process, says the "Industrial World" is to wash the peat without destroying its natural fibrous state, and to mix the resulting moist mass with a mixture of hydrated lime and an aluminum compound and press it in molds for a short time in the moist state, after which the resulting plates are allowed to harden in the air. The resultant product needs only a comparatively low pressure, and this for a short time only, and is then set out to dry in the air. The artificial wood thus produced is not hygroscopic, and in order to use it for open-air work needs no painting or further impregnation.

Copper becomes soft and malleable when strongly heated and immersed in cold water, its behavior under these circumstances being diametrically opposite to steel.

CONSTRUCTION AND MANAGEMENT OF GASOLINE ENGINES.

CARL H. CLARK.

V. Ignition Devices.

During the development of the gasoline engine there have been many different devices used for igniting the charge. These have consisted of various forms of hot tubes, naked flames, and electrical devices; the two former have, however, been gradually superceded by the electric ignition, and at the present time the latter is, in this country at least, the only one in common use.

Electric ignition is used in two ways, commonly known as "make and break" and the "jump spark" forms. The principle upon which the former depends is the formation of a spark when an electric circuit is broken. A property of the electric circuit, which need not here be discussed, causes the current to flow for a short time after the circuit is broken; it thus jumps across a short space and causes the spark. This quality is accentuated by the use of a spark coil, which will be taken up later. For the make and break spark the current from the batteries is used direct, after transforming to a higher potential by means of a suitable coil.

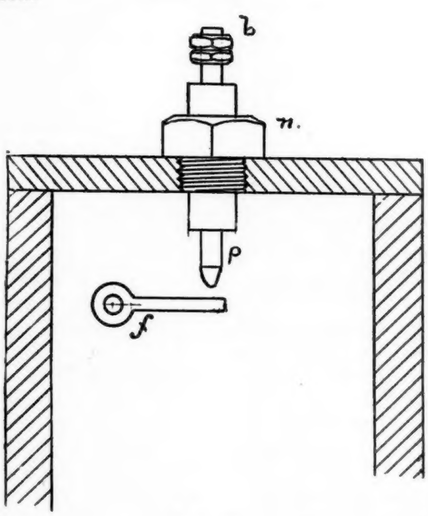


Fig. 23.

The jump spark is formed by causing a high tension current to jump across the air space between two fixed points of a spark plug. In this case the low tension battery current is transformed by passing it through an induction coil, and the high tension current is used to produce the spark.

In substance, the make and break ignition consists of two points inside the cylinder, one of which is insulated from the engine and the other is movable, allowing the circuit to be made or broken at will. The igniter gear, already referred to in a previous chapter, is connected to the movable point and is so adjusted that the points are brought together while the piston

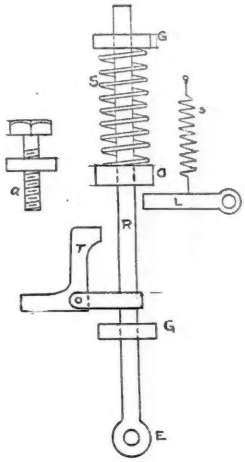


Fig. 24.

is on its upward stroke, the current then flows for a short time. At the moment of ignition the points are quickly drawn apart by a spring or some other means, and a spark occurs. The two points are shown in Fig. 9, the lower one being the moveable one and connected with the gear *I*. The igniter gear is shown in that same figure, and also at *I* in Figs. 9 and 10, at *N* in Fig 11, and at *H* in Fig. 17.

The jump spark, on the other hand, occurs between two fixed points very similar to those shown at *L* in Fig 4. One of these points must, of course, be insulated from the surrounding metal. The current then, by a commutator, is made to pass between the points at the proper time.

The engines shown in Figs. 4 ,11, 13 and 18 are of this type, no igniter gear being necessary.

A very common form of make and break igniter is shown in Figs. 23, 24 and 25. Fig. 23 is a view inside of the cylinder, showing the two points, *p* and *f*. The point *p* is at the end of a rod which is insulated from the cylinder by the insulating material *I*. It passes

through and has a binding post on the top. The whole is provided with a thread for screwing into the cylinder head. The other point *f* is pivoted, its spindle running through the walls of the cylinder and being moved by the igniter gear on the outside. Fig. 24 shows the outside gear in which *l* is a lever on the outer end of the spindle connected to the movable point *f*; and *R* is a rod guided by the guides *GG*. This rod is reciprocated by the same eccentric which operates the water pump, the eccentric strap being pivoted at *E*. On this rod is a stationary collar carrying the tappet *t* and the movable collar *c*. The screw *a* is in line with the outer end of the tappet *t*.

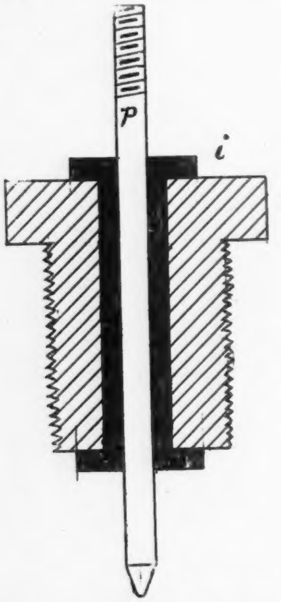


FIG. 25.

In operation the collar *c* is forced down against the lever *l* by the spring *s* pressing the lever and separating the sparking points. When the rod *R* ascends, the tappet *t* strikes the collar *c* and raises it out of contact with the lever *l*. The spring *s* then raises the lever *l* and brings the sparking point into contact, allowing the passage of the current. As the rod *R* rises still further and arrives nearly at the top of its stroke, the screw *a* strikes the outer end of the tappet *t*, throwing this end down and the upper end out, and allowing the collar *c* to snap off and descend rapidly. Forced by the spring, this collar then strikes the lever *l* and forces it down quickly, breaking the contact in the cylinder and causing the spark. As the rod *R* descends, the tappet *t* snaps over the collar *c* and is ready for the next stroke.

The contact is thus broken suddenly; the more suddenly the break, the better and more effective is the resulting spark. By turning the screw *a* up or down it may be made to strike the tappet *t* sooner or later, thus changing the time of ignition. An engine having this particular gear is shown in Fig. 9.

It will be noted that there are two rods attached to a projection on the vertical rod; the outer one is the eccentric rod and the inner leads down to and operates the water pump. This illustrates the principle of the make and break ignition, namely, that the points are brought together at some time on the up stroke, held together for the passage of the current, and then snapped apart suddenly at the proper time. The

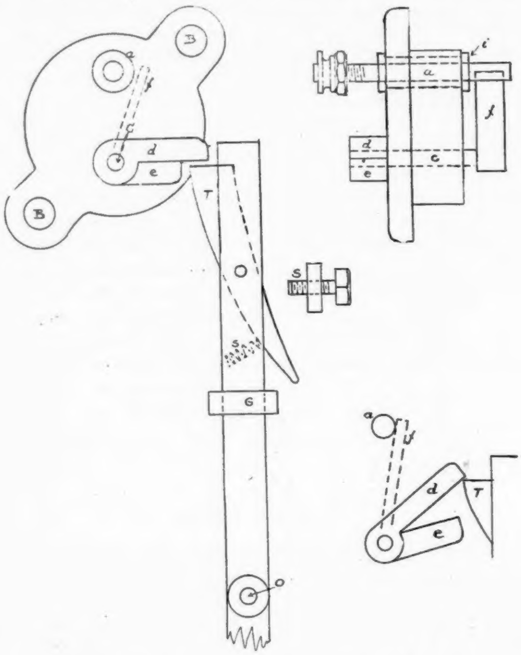


FIG. 26. FIG. 27.

points should not, of course, be held in contact longer than necessary, as this would cause unnecessary waste of battery. The mere separation of the points is not sufficient, as they must be snapped apart quickly. The collar *c* does this by its hammer action. The adjustment of the sparking points to the type of gear is a nice matter, as the pin *p* must be screwed down to the proper point by trial.

The spark points require to be cleaned at intervals, which is done by unscrewing and removing the entire upper construction. The lower point can thus be cleaned through the hole, and the upper part be cleaned and replaced.

Another type of sparking gear is given in Fig. 26, such as is fitted to the engine shown in Fig. 10, the right hand view being a side view of the other. As will be noted, both points are on a sort of plug which is bolted on to the side of the cylinder by the bolts *B B*,

allowing the points to project inside the cylinder. The point *a* is insulated from the metal of the plug by a mica bushing or sleeve. The rod *c*, which can revolve, has on its inner end the strips of metal, or flipper *f*, which makes the contact with the point *a* when the rod *c* is turned. In this case the whole combination may be removed for cleaning by taking out the bolts *B B*, without in any way disturbing the adjustment of the sparking points.

The outer end of the rod *a* has a binding screw for fastening the wire. On the outer end of the rod *c* are the two small levers *d* and *e*. The lever *e* is fast upon the rod; the lever *d* is loose and may turn, but is always held down against *a* by a coiled spring, the other end of which is attached to the rod *c*.

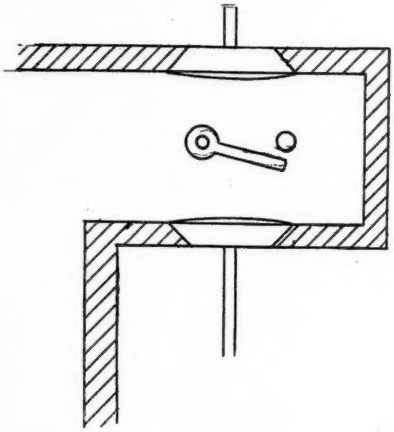


FIG. 28.

The rod *R* is given an up and down motion by the eccentric whose strap is attached at *O*. The upper end of the rod is slotted to admit the tappet *t* which is pivoted as shown. A coiled spring *s* forces the tappet out into position. In operation, the rod *R* is raised by the eccentric and the tappet t strikes the lever *d* and raises it. By means of the coiled spring before mentioned, the lever *e* and the rod *c* are turned, bringing the points inside the cylinder into contact. The position at this time is shown by Fig. 27.

The lever *e* can only rise a short distance owing to *f* striking the other spark point; the lever *J* is, however, raised higher, separating the two as shown and compressing the outside spring. As the rod *R* rises still higher the set screw *s* strikes the tail of the tappet *t*, forcing it in and drawing in the upper end. This allows the lever *a* to snap off; it descends with considerable force owing to the action of the coiled spring and, striking the lever *a* forces it down, quickly separating the sparking points. This illustrates the action of the "hammer break."

On the down stroke of the rod *R*, the tappet *t* is pressed into the slot by striking the end of lever *d*, and is forced out into place again by the spring *s*. By varying the position of the screw *s* it may be made to strike the tail of the tappet *t* earlier or later, thus regulating the time of ignition. The rod *R* is extended below and works the water pump, as shown in Fig. 10. The two gears just described are used on two cycle engines as they are driven from the main shaft and ignite on each revolution. A similar gear may be used on a four cycle engine, being driven from the valve or half time shaft, in which case the points are sometimes placed as shown in Fig. 28.

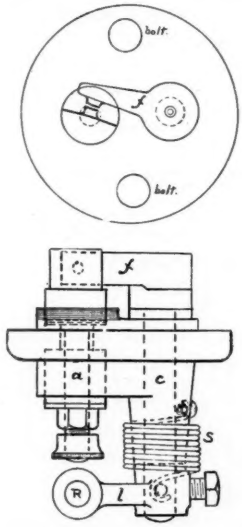


FIG. 29.

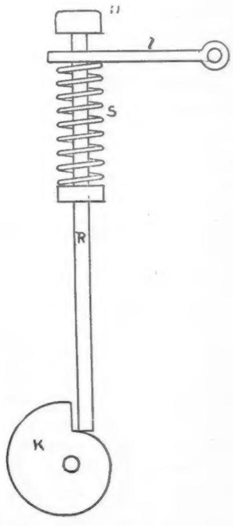


FIG. 30.

A very simple gear is shown in Figs. 29 and 30. It is in some respects similar to the preceding one, both points being on one plate. On the end of the rod *c*, Fig. 29, is the lever *l*, having at its outer end a hole through which the rod *R* passes. The coiled spring *s* is connected to a pin in the lever *l*, and tends always to keep the points separate. The rod *R*, Fig. 30, passes through the hole in the end of the lever *l*, and is encircled by a coiled spring whose upper end bears against the lever *l*, holding the head *h* of the rod *R* down against the lever *l*. On the end of the valve shaft is the cam *k*, having a step, as shown. The lower end of the rod *R* rests upon this cam. In operation the cam *k* turns toward the left, raising the rod *R*, the pressure of the spring *s* also raising the lever *l*, bringing the sparking points into contact. The lever *l* then remains stationary and the rod *R* continues to rise, separating the head *h* considerably from the lever *l*. When the cam has turned sufficiently, the rod drops off the step, and is forced down by its own weight and the spring *s*; the head *h* strikes the lever *l* a sharp blow and carries it down with it, separating the points. The time of ignition is varied by moving the lower end of the rod *R* to the left, causing it to drop off earlier or later. This gear will only operate in one direction;

The cam k is, however, provided with a ratchet arrangement to prevent damage when the engine is turned in the opposite direction to that in which it runs.

These examples will illustrate the principles of action. A successful ignition should have the following qualities: viz., it should separate the points quickly, as the strength of the spark depends upon this; it should be simple, with as few parts as possible; some means should be provided for changing the time of ignition while the engine is running, as the best point of ignition is likely to vary for different speeds; it should be easy to clean and keep in order; the sparking points should preferably be tipped with platinum or similar metal, as steel points are worn away rapidly and soon become fouled.

FREAK ENGINE INVENTIONS.

The advent of the steam engine was the signal for a host of ingenious and amusing inventions, and the writer is enabled, through the courtesy of an official of the Patent Office at Washington, to afford this brief account of these old railway patents.

One inventor, who appears very early on the scene, says the "Industrial World" was very sure that in winter the steam engine would be comparatively useless, because the thin coating of frost that would gather in the morning upon the rails would effectually hinder the wheels from moving along. Of course, this objecter had a remedy to offer. His rails were to be hollow in order to allow hot water to circulate through them, thus keeping the metal warm and preventing the formation of frost.

Another ingenious spirit, fully persuaded that no smooth wheeled vehicle could be made to move along ordinary roads, fitted his piston rods not to wheels, but to a set of legs that kicked into the road beneath the engine, moving it much as a punt is poled in the water, only in this case there were to be found several poles instead of one.

Decidedly more interesting than an engine that kicked its way along was one that was to actually walk on four legs. There were several varieties of these steam-walkers, one of which burst on its trial trip and killed ten persons. It was not till Hedley exploded all these ingenious theories by simply trying how a smooth wheel would really act on a smooth road that the wonderful inventions ceased.

The idea of danger was always a very prominent one in the minds of these early inventors. One was so convinced that "accidents on railroads would be frequent,' that he proposed to minimize the loss of life by attaching the train to the engine by a long rope, so that in the event of collision only the enginemen would suffer.

Another adopted the expedient of a feather-bed placed between the buffers of the cars, so that "a shock could not be transmitted," and a third and still more ingenious patentee, proposed fixing a pair of rails along the top of the train, falling at a gradient fore and aft, so that in the event of another train meeting or overtaking it, the two could pass over and under each other and both could go their way rejoicing.

CHARGING STORAGE BATTERIES.

Storage batteries are now used in so many central stations that station engineers should be familiar with their peculiarities. When a battery is being charged it is important to know when to stop charging. If a battery is only partially charged it is not being used to the best advantage because there is no use in having a battery of large storage capacity if this capacity is not made use of. On the other hand, it is equally true that a battery is not being used to the best advantage if it is repeatedly overcharged.

The question then, is to determine the point at which charging should be stopped. When a battery is discharged, the voltage of each cell falls, and it is never advisable to discharge the battery to such an extent that the voltage falls below 1.7 volt per cell. In every-day work it is advisable to keep the voltage above this point, say 1.8 volts, because it is always well to have some reserve capacity in the battery.

We will assume then, that the voltage per cell is about 1.8 when the charging begins. As the cells become charged, the voltage gradually rises until it reaches about 2 6 to 2.7 volts per cell. In passing, let us state that these voltage readings are taken when the normal charge or discharge current is flowing, as the case may be. In storage-battery work readings of voltage taken while the current is not flowing are of little use. The normal current is usually taken as the current which will discharge a fully charged battery in 8 hours. Batteries should be charged at about the 8 hour rate. It is not advisable to charge at the maximum rate except in cases of emergency.

After the voltage has come up to about 2.5, or 2.7 volts, it remains stationary, and further charging at the normal rate does not increase it. Of course if the charging current is increased above normal, the voltage will increase somewhat, but under ordinary conditions the charging current should not be forced above normal, particularly at the charging where the voltage attains a fixed value, and does not increase during, say 15 minutes, it is a sign that the battery has become fully charged. The exact value that the voltage will attain depends somewhat on the age of the plates and also, as stated above, on the value of the charging current. The point to note is not so much what the final value of the voltage is, but whether it has reached a stationary value or not.

Another indication of full charge is the specific gravity of the electrolyte. an acid solution in the cells. As the battery becomes charged this solution becomes

denser, because of the formation of sulphuric acid. The specific gravity, which is readily measured by means of a battery hydrometer, therefore gradually increases. The specific gravity is usually about 1.2 when the cells are charged, but the point to be noted is that when the electrolyte ceases to increase in density. When this occurs, it is another sign that the cells are fully charged.

LIQUID AIR AT LOW COST.

Reduced cost of liquid air production is indicated by an article in the London "Times." Recent experiments in England of an invention by Mr. Kundsen, a Dane, furnished liquid air at one-sixth of the present market price, and give promise of an ultimate low price of a fraction over 2 cents per gallon. The result is secured by purely mechanical means, without an atom of added chemicals. Atmospheric air is first purified and then compressed by 2500 pounds to the square inch. It is finally reduced to 135 pounds to the square inch, which then cools and liquefies the high-pressure air.

The oxygen gas produced by separating the nitrogen from the liquid air is claimed to be purer than by the old methed, and can be supplied in the liquid as well as the gaseous form. One gallon of liquid air equals approximately 128 cubic feet of oxygen gas, which retails at 6 cents per cubic foot. The new price is 1 cent. Liquid air has been successfully used in coal mines as as an explesive, being quite safe where fire damp and other explosive gases exist. Liquid oxygen is also used for welding steel pipes, boiler shells, and plates for shipbuilding instead of riveting.

That oxygen and nitrogen can be separated from liquid air and sold at retail at $1.20 per gallon shows great commercial possibilities. The use of nitrogen for agricultural purposes opens yet another field. The maturing ef liquors will be helped by liquid air. as also the preservation and purification of milk. As a motive power its use is considered to be quite practicable for small powers. The British Government is already carrying out a number of experiments with a view to the utilization of liquid air for various purposes.

WHY IRON RUSTS.

It was formerly believed that the reason why iron exposed to the atmosphere rusted was because it simply oxidized. Afterward it was suggested that the first stage in the rusting of this metal is the production under the influence of carbonic acid, of ferrous carbonate, which is afterward converted into rust. Five years ago, however, Professor Dunster put forward a new explanation. He thought that pure oxygen in the presence of water attacked the iron, giving rise to ferrous oxide and hydrogen peroxide, and that a portion of the latter converted the ferrous oxide into rust, while the remainder directly attacks the iron, causing a fresh quantity of ferrous oxide, when this is again oxidized in a very similar way.

Dr. G. T. Moody has shown that if very special precautions are taken to exclude all traces of carbon dioxide, then iron may be left in contact with pure oxygen and water for many weeks without undergoing any change. In one of the experiments thirty times as much oxygen as is required to convert the whole of the iron into oxide was passed during the course of a few weeks, but there was absolutely no rust. But if the air were not freed from carbon dioxide rusting commenced at once, and in seventy-two hours the whole of the metal was corroded. There would seem to be no basis, therefore, for the assumtion that iron can be caused to rust by pure water and pure oxygen only.

TRAINING ELECTRICAL ENGINEERS.

One of the problems in many of the larger of America's industries is the necessity of always having available a corps of carefully trained men to take positions which may become vacant and to fill new places, the establishment of which is made necessary by the growth of an industry. This is done by the apprentice system, by night schools, or by private or "works high schools." An example of the last mentioned of these methods in the lighting field is the School of Practice recently organized by the president of the Denver Gas and Electric Company, a school in which the students will be properly drilled in every branch of the gas and electric business.

The students in this school are to be only those who are the graduates of the highest technical schools and colleges in the country. Although all the students will have already completed various courses in engineering, yet their training will have been rather along theoretical lines, while the training afforded by this school will be a two years' course along practical lines. In addition to the technical subjects naturally embraced in this higher course, the students will be obliged to also study subjects connected with the commercial side of the lighting question, such as the best methods of selling gas and electricity, etc. It is expected that upon the completion of this two years' course that the students will be all-round lighting engineers, fitted to run a plant and sell its products.

SCIENCE AND INDUSTRY.

A waterproof cement has been patented in Germany. A mixture of vegetable wax and caustic lime, in boiling water, is added to unground Portland cement clinker, and all ground together. The inventor makes the claim that one-half-inch coating of this cement placed on a brick wall will render it absolutely waterproof. The formula is given as follows; To each 200 lbs. of cement clinker is added a mixture of three-fourths

pound of Japan vegetable or berry wax, and one ounce of caustic lime, which has been dissolved in fourteen pints of boiling water. These ingredients are thoroughly mixed and, when cooled, are dried and ground very fine with cement clinker.

The "Mechanical World" recently contained an epitome of a lecture by A. B. Roxburgh, of the National Gas Engine Company, Ltd., in which it was stated that about one-fourth of all the gas made in Great Britain is employed in driving gas engines. The lecturer estimated that in the United Kingdem alone there are manufactured at least 200 gas engines per week. Averaging them at the very low size of ten brake horsepower each would give a weekly production of 2000 horse power. It was deemed likely, however, that the actual amount is double that figure.

In Cuba alcohol is produced and sold from 12 to 15 cents a gallon, and it is said to make an excellent fuel for running engines. It produces no soot or disagreeable odors. When the law recently passed by Congress to denaturize alcohol in the United States becomes operative, it is expected greatly to increase the use of the article both for fuel and other purposes.

Uranium is a remarkably heavy metal having the high specific gravity of 18.6. It was discovered in 1789 by a German chemist in the mineral uraninite or pitchblende. Uranium is contained in uraninite gumnite, a hydrated calcium lead uranium silicate, torbenite, a hydrated copper uranium phosphate. The metal is prepared by heating a mixture of uranium chloride, sodium chloride and carbon or of uranium chloride, sodium chloride and metallic sodium. It is a white metal resembling nickel.

The practice of hardening steel dates back to the remotest antiquity. Homer, Pliny and Lucretius refer to the hardness imparted to iron taken from the forge and plunged in water. The ancient Egyptians heated meteoric iron in the forge at a temperature somewhat below the melting point, until it had absorbed enough carbon from the fuel to give it the requisite hardening properties, and then fashioned their weapons and tools from the metal thus obtained.

The units of weights and measures in the United are practically those used in the colonies prior to the formation of our government. While Congress has never definitely authorized the weights and measures in common use, it has sanctioned their use by its act of June 14. 1836, providing that accurate copies of the yard, pound, etc., be furnished as standards to each state.

The volumometer is an instrument for determining the specific gravity of solids by measuring the amount of water or other liquid displaced by it. A simple form is a flask having a long narrow neck and an opening at the side through which the solid may be introduced, the neck being graduated from the bottom upward. The flask is filled to the zero mark with some fluid in which the solid is not soluble; on turning it on its side the stopper is removed and solid introduced. When turned back to an upright posture again the liquid is forced up the stem and the volume reading is the amount of liquid displaced by the solid. From this the specific gravity is easily obtained.

The lifetime of a good watch is 50 years. In its daily duties the balance vibrates 18,000 times every hour, 432,000 time a day, or 157,680,000 times a year. The hair spring makes a similar number of vibrations and an equal number of ticks from the escapement. If it is a really good watch, multiply 157,680,000 by 50, which gives 7,884,000,000 pulsations for 50 years. The chances are that the watch may even then be in serviceable condition. This is a marvellous record, considering the small quantity of food that has been consumed by its constant action. We say food because whatever labors must be fed, and the watch "lives" on about 16 inches of mainspring every 24 hours, which furnishes the power.

In paints the most permanent of blues is ultra marine, while Prussian blue and indigo are liable to fade. Cobalt, however, is the most lasting of all blues. Among the reds the only really unchanging colors are vermilion and the ochres; madders, carmines and crimson lakes are likely to fade, the latter two quite rapidly. Oxide of chromium is a permanent green. The staple yellows are Naples yellow, cadmium, raw sienna and yellow ochre. In brown, raw and burnt umber retain their tint forever.

Water gas is a mixture of gases produced by the action of steam on incandescent carbon. The carbon first decomposes the steam, forming hydrogen and carbon dioxide and the latter gas then combines with more carbon to form the inflammable carbon monoxide. Thus water gas is mainly a mixture of hydrogen and carbon monoxide. Pure water gas is non-luminous, but it is rendered luminous, by mixing with various gases obtained from petroleum, the luminous material being known as carburetted water gas.

It is stated in Washington on good authority that the War Department will probably buy several automobile ambulances. A car of this type was recently purchased from a company, and has been subjected to trials by the medical department of the army. The officers have pronounced the ambulance of great value although they are of the opinion that some changes in the arrangement and equipment of the vehicles should be made. It is understood that these ambulances will be used in the field in case of war, and will be attached to every brigade hospital. One of the principal advantages of these vehicles is their speed and the fact that they do not require horses. The medical officers who have been examining the motor ambulances say that there will be no great difficulty in making the required changes in the ambulances.

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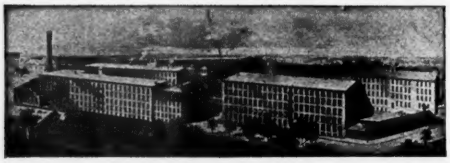

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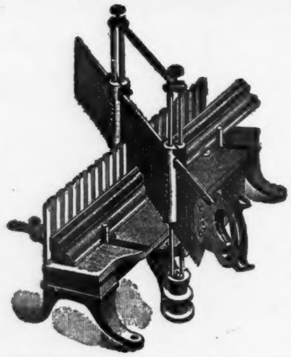

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The clamping lever under the swivel bar is held up by means of a swinging thumb piece, the operator may freely swing the saw to any line on the work, and by a slight pressure against the thumb piece, clamping lever is released and box automatically locked in position at any point.

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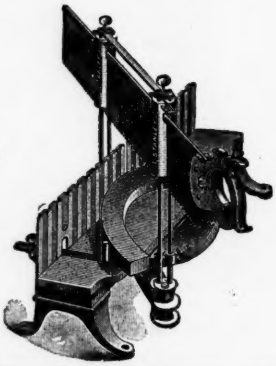

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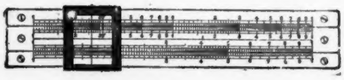

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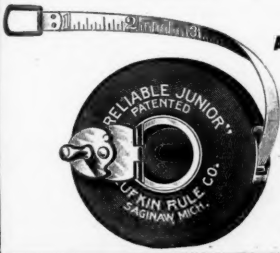

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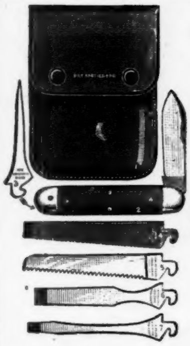

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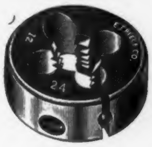

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